



SATURDAY, FEBRUARY 21, 1874.

Wood's Rock-Drilling Machine.

Rock-drilling machines which are operated by steam or compressed air are receiving more and more attention. The economy of drilling by such machines has already been proved under many circumstances. At first, in Mount Ceniz and the earlier operations in Hoosac Tunnel, the only gain was in time, the cost of drilling exceeding that by hand labor. The increased cost was on account of the imperfections of the machines used—an incident common to most new machinery. One of the greatest practical difficulties has been to make them durable. They are required to operate rapidly, and the work which they do is the most severe which is required of any machine in existence. Making 900 dead blows upon hard rock must react severely upon the machine. The universal experience has been that the machines will sooner or later break in some

hammer with a view of adopting its main feature in the proposed drill. Mr. Fowle took a patent for a drill on this plan in 1851, in which the drill was attached to the piston-rod. Numerous drilling machines have been made in various parts of the world upon the plans indicated by Messrs. Couch and Fowle. The first direct-action machine for working upon stone was patented by Mr. Nasmyth, of England, which was constructed on the plan of his direct-acting steam hammer.

It is impossible to determine the amount which inventors have expended in this country in perfecting a portable power drilling machine, but from information which we have in hand, it is safe to say that it exceeds \$200,000. Some sixty or seventy patents have been issued for machines, besides many others for improvements or devices in minor parts.

The success of power drills at Mont Ceniz was the turning point in the use of power drills. Before that time their use had been fragmentary and was soon abandoned; but through the ingenuity and perseverance of M. Sommeiller, the machines were kept in this work from the time of their first introduction until its completion. Their use in Hoosac Tunnel was the turning point in this country, and at the present day hundreds of steam drills are in use.

long or short at pleasure, and this adjustment can be made instantly when the drill is running at any speed. By turning the stem sufficiently in either direction, the piston may be suddenly stopped at either the forward or rear end of the cylinder. If the piston goes too far forward in the cylinder, it will so reverse the valve as to let steam behind the piston and keep it pressed forward, and thus the machine will stop itself before the piston strikes the forward head. This will prevent damage to the machine, if the drill passes suddenly from hard to soft rock, or if the feed is not properly operated. At the rear end of the cylinder is a steam buffer, which prevents the piston from striking the rear head of the cylinder. As there is no shock upon the valve gear, there is no danger of its breaking.

The rotation is performed by a single click, which is contained in the rotation box *B*. Between the click and the cap of the box is a block of rubber, or other elastic body, to prevent a shock upon the machine in a rapid rotation, and thus prevent breakages.

As the drilling advances, the machine must follow up with the work. This advance feed is perfectly regulated, so that the cylinder cannot get beyond its proper place. Its opera-



part, and the practical point has been to so construct them that they would not break frequently. For some kinds of work, such as making large holes in hard rocks, the machines are necessarily heavy; but to make all machines heavy would practically make them non-portable and prevent their use in many kinds of work. In these respects a rock-drilling machine is a paradox. It is required to be excessively strong for durability, and at the same time excessively light for portability. Wood's driller is intended to go far towards solving this paradox.

The steam rock-drilling machine is an American invention. According to the best of our information Mr. J. J. Couch, of Brooklyn, (formerly of Philadelphia,) invented the first drilling machine in which the drill was driven by steam power independently of gravity. Before that time drills had been raised by power and allowed to drop, thus drilling vertically, but Mr. Couch drove the drill in any direction. His patent was granted in 1849. His machine was too complicated to become practical for such severe work, but he afterwards simplified it by making the main piston of an engine hollow and passing the drill through it. He employed one J. W. Fowle in the construction of the machine, and while thus engaged they examined a Nasmyth's direct-action steam

Mr. Wood began his labors upon a steam drill several years since, but on account of embarrassments of various kinds, to say nothing of the practical difficulties to be overcome, he did not complete his invention till quite recently. The cut shows one of Mr. Wood's three-inch drills, but the principles of construction and mode of operation of all the different sizes are essentially the same.

The drill is attached directly to the piston-rod at *C* by a chuck, whose operation is automatic. The shank of the drill is loosely inserted into the chuck, and when the drill strikes the rock the chuck suddenly seizes the tool and holds it firmly. There are no screws, bolts or pins about it. The drill is easily and quickly loosened by means of a hammer by driving the chuck back to place. Another desirable feature of the chuck is, that it will accommodate itself to shanks of different sizes, so that if they are not made of equal size, or wear unequally, the chuck still holds them firmly.

The valve movement is perfectly easy, there being no shock upon any part of it. There are no tappets, cams, levers, friction-pieces, grabs, buffers, or other similar devices to aid in operating it. The valve is not reversed until the blow is struck, and yet its operation is not delicate. By turning the stem *A* to the right or left the stroke of the drill can be made

tion is positive, and does not depend upon friction to keep it in check. The feed is operated either automatically or by hand. With the device here used it is believed that the hand feed is the safest and most reliable that it is possible to have. The operator has simply to press slightly on the handle and turn it when and as far as the machine will permit him. Nothing is in doubt and nothing dependent upon sound. It is not necessary for him to have his eyes upon it; and if through laziness or malice he stops the feed the machine will stop itself after a few blows, as before described. The automatic feed imitates the hand feed except that it is neither lazy nor malicious, and if it breaks the machine will stop itself after a few blows, the same as before stated. If the automatic feed gets out of repair, the hand feed can at once be resorted to with the same certainty of action as if the automatic feed had not been put on.

Every part of the machine is easily accessible. It can be quickly taken apart and easily and quickly put together again. All the working pieces are simple and durable.

Regarding the durability and portability of the machine, Messrs. M. Truesdell & Sons, of New York, after having had a three-inch drill working in a quarry for four months, wrote Mr. Wood that they used it in a steep quarry full of seams

where a stand had to be made for the tender of two poles and plank, and the machine drawn up with a rope; and that it drilled eight feet an hour of holes $2\frac{1}{2}$ inches in diameter, when the best men could not average more than nine feet a day of $1\frac{1}{2}$ -inch holes, and that no repairs had been needed in that time, except mending a bolt of the tripod.

The speed of drilling may also be inferred from a trial in drilling a block of Quincy granite with a 3-inch machine in Mr. Church's yard at Newark, N. J. A 1½-inch hole eleven inches deep was drilled in two and one-half minutes, and another 3-inch hole, 8¼ inches deep, in four minutes.

These drills have been used with satisfactory results in various places. At present they are being made in four sizes. The smallest size has a cylinder the bore of which is $2\frac{1}{2}$ inches. The machine is 18 inches long and weighs exclusive of its supports about 95 pounds. It may be mounted on a tripod and can be easily managed by a single man. It is for making plug and feather holes in quarries, gadding holes, block holes, and for headings in very soft rock.

The next size is the 3-inch machine shown in the cut. It is 24 inches long and weighs 190 pounds. It is for drifting in mines, headings in tunnels, stoping, gadding in hard rocks, quarry work and open-cut work. It carries inch or 1½-inch steel, as may be desired.

The next size is a 4-inch machine and is used for tunnelling and open work. It carries 1 $\frac{1}{4}$ -inch steel and will make holes of any desired size.

The largest size is a 5-inch machine and is intended for all kinds of heavy work; will drill holes 25 feet deep. Further information may be had of DeVolson Wood, Hoboken, N. J.

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CATECHISM OF THE LOCOMOTIVE.

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PART V.—(CONTINUED.)

QUESTION 55. What advantages result from using steam expansively?

Answer. There is a very important saving in the amount of steam required to do a given amount of work, and the strains and shocks which are produced by the rapid motion of the piston and other reciprocating and revolving parts of the engine are very much diminished by allowing the steam to expand, and thus become reduced in pressure during the latter part of the stroke.

QUESTION 56. *How is steam saved by using it expansively?*

Answer. Less steam is required when it is used expansively : 1. Because when steam of a high pressure is introduced into the cylinder, and allowed to expand until its pressure is comparatively low, it escapes at a lower pressure than that of the average pressure during the whole stroke. If steam is worked full stroke of a pressure equal to the average pressure, it would exert exactly the same force on the piston as the steam of higher pressure did when working expansively, but the pressure in the one case when the piston reaches the end of the stroke, or the *final pressure*, as it is called, would be considerably lower than in the other. The pressure of steam represents *energy*, or *capacity for doing work*, and therefore if we allow it to escape with a comparative'y high pressure without doing work, it is a waste of energy. To illustrate this, we will take the same conditions which were used in the answer to question 54, in calculating the average pressure. In that case the mean absolute pressure of the steam was 69.95 pounds per square inch, but the pressure at the end of the stroke when the steam escaped was only 33½ pounds absolute. If, therefore, steam had been used of the average pressure through the whole stroke, it would have escaped with a pressure of 69.95 pounds, or more than twice that of the expanded steam, and the work done in both cases would have been the same.

2. There is also another incidental advantage in this, because low-pressure steam can be exhausted more quickly from a cylinder than steam of a high pressure, and consequently there is less resistance, or *back pressure* as it is called, in the exhausted end of the cylinder to the movement of the piston.

3. The causes which produce the greatest economy when steam is used expansively cannot be fully explained without discussing principles of science more abstruse than it is desirable to introduce here. They can, however, with the aid of the following table of the "Properties of Steam" be illustrated by a few simple calculations, so that the economy of using steam expansively will be apparent:

PROPERTIES OF SATURATED STEAM.

Total pressure per sq. inch, measured from a vacuum.....		Pressure above the atmosphere.....	Sensible temperature in Fahrenheit degrees.....	Total heat in degrees from zero of Fahrenheit.....	Weight of one cubic foot of steam.....	Remarks.....
Lb.	Lb.	Deg.	Deg.	Lb.	2058.8	
1	..	102.1	1144.5	.0030	1072.1	
2	..	126.3	1151.7	.0058	732.2	
3	..	141.6	1156.6	.0085	568.8	
4	..	153.1	1160.1	.0112	452.1	
5	..	162.3	1162.9	.0138	381.1	
6	..	170.2	1165.3	.0163	329.9	
7	..	176.9	1167.3	.0189	290.9	
8	..	182.9	1169.2	.0214	260.4	
9	..	188.3	1170.8	.0239	235.5	
10	..	193.3	1172.3	.0264	215.7	
11	..	197.8	1173.7	.0289	198.8	
12	..	202.0	1175.0	.0314	184.8	
13	..	205.9	1176.2	.0338	172.2	
14	..	209.6	1177.3	.0362	164.4	
14.7	0.	212.0	1178.1	.0380	161.1	
15	.3	213.1	1178.4	.0387		

PROPERTIES OF SATURATED STEAM—CONTINUED

Steam compared with the water from which it was raised.....					
Weight of one cubic foot of steam.....	Total heat in degrees from zero of Fahrenheit.....	Sensible temperature in Fahrenheit degrees.....	Pressure above the atmosphere.....	Total pressure per sq. inch measured from a vacuum.....	
Lb.	Deg.	Deg.	Lb.	Lb.	
.0411	1179.4	216.3	1.3	16	151
.0435	1180.3	219.6	2.3	17	143
.0459	1181.2	222.4	3.3	18	135
.0483	1182.1	225.3	4.3	19	129
.0507	1182.9	228.0	5.3	20	123
.0531	1183.7	230.6	6.3	21	117
.0555	1184.5	233.1	7.3	22	112
.0580	1185.2	235.5	8.3	23	107
.0601	1185.9	237.8	9.3	24	103
.0625	1186.6	240.1	10.3	25	99
.0650	1187.3	242.5	11.3	26	95
.0673	1187.8	244.4	12.3	27	92
.0696	1188.4	246.4	13.3	28	89
.0719	1189.1	248.4	14.3	29	86
.0743	1189.8	250.4	15.3	30	83
.0766	1190.4	252.2	16.3	31	81
.0789	1190.9	254.1	17.3	32	78
.0812	1191.5	255.9	18.3	33	76
.0835	1192.0	257.6	19.3	34	74
.0858	1192.5	259.3	20.3	35	72
.0881	1193.0	260.9	21.3	36	70
.0905	1193.5	262.6	22.3	37	68
.0929	1194.0	264.2	23.3	38	67
.0952	1194.5	265.8	24.3	39	65
.0974	1194.9	267.3	25.3	40	64
.0996	1195.4	268.7	26.3	41	62
.1020	1195.8	270.3	27.3	42	61
.1042	1196.2	271.6	28.3	43	59
.1065	1196.6	273.0	29.3	44	58
.1089	1197.1	274.4	30.3	45	57
.1111	1197.5	275.8	31.3	46	56
.1133	1197.9	277.1	32.3	47	55
.1156	1198.3	278.4	33.3	48	53
.1179	1198.7	279.7	34.3	49	52
.1202	1199.1	281.0	35.3	50	51
.1224	1199.5	282.3	36.3	51	50
.1246	1199.9	283.5	37.3	52	49
.1269	1200.3	284.7	38.3	53	48
.1291	1200.6	285.9	39.3	54	47
.1314	1201.0	287.1	40.3	55	46
.1336	1201.3	288.2	41.3	56	45
.1364	1201.7	289.3	42.3	57	44
.1380	1202.0	290.4	43.3	58	43
.1403	1202.4	291.6	44.3	59	42
.1425	1202.7	292.7	45.3	60	41
.1447	1203.1	293.8	46.3	61	40
.1469	1203.4	294.8	47.3	62	39
.1493	1203.7	295.9	48.3	63	38
.1516	1204.0	296.9	49.3	64	37
.1538	1204.3	298.0	50.3	65	36
.1560	1204.6	299.0	51.3	66	35
.1583	1204.9	300.0	52.3	67	34
.1605	1205.2	300.9	53.3	68	33
.1627	1205.5	301.9	54.3	69	32
.1648	1205.8	302.9	55.3	70	31
.1670	1206.1	303.9	56.3	71	30
.1692	1206.3	304.8	57.3	72	29
.1714	1206.6	305.7	58.3	73	28
.1736	1206.9	306.6	59.3	74	27
.1759	1207.2	307.5	60.3	75	26
.1782	1207.4	308.4	61.3	76	25
.1804	1207.7	309.3	62.3	77	24
.1826	1208.0	310.2	63.3	78	23
.1848	1208.3	311.1	64.3	79	22
.1869	1208.5	312.0	65.3	80	21
.1891	1208.8	312.8	66.3	81	20
.1913	1209.1	313.6	67.3	82	19
.1935	1209.4	314.5	68.3	83	18
.1957	1209.6	315.3	69.3	84	17
.1980	1209.9	316.1	70.3	85	16
.2002	1210.1	316.9	71.3	86	15
.2024	1210.4	317.8	72.3	87	14
.2044	1210.6	318.6	73.3	88	13
.2067	1210.9	319.4	74.3	89	12
.2089	1211.1	320.2	75.3	90	11
.2111	1211.3	321.0	76.3	91	10
.2133	1211.5	321.7	77.3	92	9
.2155	1211.8	322.5	78.3	93	8
.2176	1212.0	323.3	79.3	94	7
.2198	1212.3	324.1	80.3	95	6
.2219	1212.5	324.8	81.3	96	5
.2241	1212.8	325.6	82.3	97	4
.2263	1213.0	326.3	83.3	98	3
.2285	1213.2	327.1	84.3	99	2
.2307	1213.4	327.9	85.3	100	1
.2329	1213.6	328.5	86.3	101	
.2351	1213.8	329.1	87.3	102	
.2373	1214.0	329.9	88.3	103	
.2393	1214.2	330.6	89.3	104	
.2414	1214.4	331.3	90.3	105	
.2435	1214.6	331.9	91.3	106	
.2456	1214.8	332.6	92.3	107	
.2477	1215.0	333.3	93.3	108	
.2499	1215.3	334.0	94.3	109	
.2521	1215.5	334.6	95.3	110	
.2543	1215.7	335.3	96.3	111	
.2564	1215.9	336.0	97.3	112	
.2586	1216.1	336.7	98.3	113	
.2607	1216.3	337.4	99.3	114	
.2628	1216.5	338.0	100.3	115	
.2649	1216.7	338.6	101.3	116	
.2674	1216.9	339.3	102.3	117	
.2698	1217.1	339.9	103.3	118	
.2738	1217.3	340.5	104.3	119	
.2759	1217.4	341.1	105.3	120	
.2780	1217.6	341.8	106.3	121	
.2801	1217.8	342.4	107.3	122	
.2822	1218.0	343.0	108.3	123	
.2845	1218.2	343.6	109.3	124	
.2867	1218.4	344.3	110.3	125	
.2889	1218.6	344.8	111.3	126	
.2911	1218.8	345.4	112.3	127	

PROPERTIES OF SATURATED STEAM—Continued.

Total pressure per sq. inch, measured from a vacuum.....		Pressure above the atmosphere.....	Reasonable temperature in Fahrenheit degrees.....	Total heat in degrees from zero of Fahrenheit.....	Weight of one cubic foot of steam.....	Relative volume of the steam compared with the water from which it was raised.....
Lb.	Lb.	Deg.	Deg.	Deg.	Lb.	
128	113.3	346.0		1218.9	.2933	214
129	114.3	346.6		1219.1	.2955	212
130	115.3	347.2		1219.3	.2977	211
131	116.3	347.8		1219.5	.2999	209
132	117.3	348.3		1219.6	.3020	208
133	118.3	348.9		1219.8	.3040	206
134	119.3	349.5		1220.0	.3060	205
135	120.3	350.1		1220.2	.3080	203
136	121.3	350.6		1220.3	.3101	202
137	122.3	351.2		1220.5	.3121	200
138	123.3	351.8		1220.7	.3142	199
139	124.3	352.4		1220.9	.3162	198
140	125.3	352.9		1221.0	.3184	197
141	126.3	353.5		1221.2	.3206	195
142	127.3	354.0		1221.4	.3228	194
143	128.3	354.5		1221.6	.3250	193
144	129.3	355.0		1221.7	.3273	192
145	130.3	355.6		1221.9	.3294	190
146	131.3	356.1		1222.0	.3315	189
147	132.3	356.7		1222.2	.3336	188
148	133.3	357.2		1222.3	.3357	187
149	134.3	357.8		1222.5	.3377	186
150	135.3	358.3		1222.7	.3397	184
155	140.3	361.0		1223.5	.3500	179
160	145.3	363.4		1224.2	.3607	174
165	150.3	366.0		1224.9	.3714	169
170	155.3	368.2		1225.7	.3821	164
175	160.3	370.8		1226.4	.3928	159
180	165.3	372.9		1227.1	.4035	155
185	170.3	375.3		1227.8	.4142	151
190	175.3	377.5		1228.5	.4250	148
195	180.3	379.7		1229.2	.4357	144
200	185.3	381.7		1229.8	.4464	141
210	195.3	386.0		1231.1	.4668	135
220	205.3	389.9		1232.3	.4872	129
230	215.3	393.8		1233.5	.5072	123
240	225.3	397.5		1234.6	.5270	119
250	235.3	401.1		1235.7	.5471	114
260	245.3	404.5		1236.8	.5670	110
270	255.3	407.9		1237.8	.5871	106
280	265.3	411.2		1238.8	.6070	102
290	275.3	414.4		1239.8	.6268	99
300	285.3	417.5		1240.7	.6469	96

For the basis of the calculations the same data and dimensions will be employed that were used in the previous illustrations; that is, a cylinder of 16 in. diameter and piston with 24 in. stroke and steam of 100 lbs. absolute pressure cut off at 8 in. of the stroke. We will suppose further that the steam used is generated from water of a temperature of 60 degrees, and we will then calculate the total number of units of heat in the steam used for each stroke of the piston. The area of a piston 16 in. in diameter is 201 square inches; and as the steam is admitted until the piston moves 8 inches of its stroke, therefore the quantity of steam would be 8 times 201 cubic inches, or

$$\frac{261}{8} \text{ cubic in.} = \frac{1608}{1728} \text{ cubic ft.}$$

From the table it will be seen that one cubic foot of steam of 100 lbs. pressure weighs .2907 lbs.; therefore the weight of the fraction of a cubic foot given above would be calculated as follows:

$$\begin{array}{r}
 .2307 \\
 1606 \\
 \hline
 19456 \\
 18043 \\
 2307 \\
 \hline
 1725970.9656(.2146 \text{ lb.} = \text{weight of } 1606 \text{ cubic in. of} \\
 8456 \text{ steam of } 100 \text{ lbs. absolute pressure.})
 \end{array}$$

2536
1728

8086
6912

11730
10368

1369

From the table it will be seen that the total heat above zero of steam of 100 lbs. absolute pressure is 1213.4 degrees. That is, as was explained in answer to Question 39,† in order to boil water under a pressure of 100 lbs. per square inch we must first heat water up to 327.9 degrees, and then to convert it into steam 885.5 degrees more must be added. It was also explained in the answer to Question 34 that one pound of water heated one degree is the standard of measurement or *unit of heat*. Now if we have 1 lb. of water with a temperature of zero, evidently it will take 1213.4 *units of heat* to convert it into steam of 100 lbs. absolute pressure. But as the water from which our steam was generated had a temperature of 60 degrees, we must deduct that much from 1213.4

1183.4
60

1183.4 = units of heat in one pound of steam of 100 lbs. absolute pressure generated from water of 60 degrees temperature.

If now one pound of steam has 1153.4 units of heat, the fol-

* This table is copied from Colburn's Treatise on the Locomotive Engine.

lowing calculation will give the units of heat in 2146 lbs.:

1153.4
2146
89204
46196
11534
28068

247.51904=Units of heat in 2146 lbs., or 1008 cubic in. of steam of 100 lbs. absolute pressure.

It was shown in answer to Question 54 that the mean pressure of steam of 100 lbs. cut off at 8 in. of the stroke was 69.95 lbs. per square inch. Disregarding the small fraction, we will call it 70 lbs. Now if we admit steam of this pressure through the whole stroke of the piston, we will use 4,824 cubic inches. It will be found by a calculation similar to the above, that to generate this quantity of steam of 70 lbs. pressure from water of a temperature of 60 degrees would require 527.4 units of heat, or more than twice as many as were required to do the same work with steam of 100 lbs. pressure cut off at 8 inches and when using it expansively during the rest of the stroke. The actual difference in practice is not so great as this, because the loss of heat from radiation and condensation in the cylinder and other causes is greater when steam of a high pressure is expanded than when lower pressure steam is admitted through the whole stroke. But after allowance is made for all such sources of loss and waste, there is still an enormous gain from using steam expansively.

QUESTION 57. What is meant by wire drawn steam?

Answer. It is the fall which the pressure of the steam undergoes during its passage from the boiler to the cylinder,* and which is due to the contracted opening of the steam pipes or valves.

QUESTION 58. What is the economical effect of reducing the pressure, or of wire-drawing it by partially closing the valve by which it is admitted to the cylinder.

Answer.—By reducing the pressure of steam in this or any other way, it is necessary in doing the same amount of work to admit steam to the cylinder for a longer period, and therefore to reduce the degree of expansion. To illustrate the effect of this, we will estimate the total heat required to exert a pressure of 70 lbs. on the piston described above. It will be assumed that the steam pressure in the boiler is 100 lbs. absolute, and that this is wire-drawn down to 70 lbs. and admitted to the cylinder through the whole stroke. As was shown in the preceding answer, 4,824 cubic inches of steam are required to fill the cylinder. Now 3,446 cubic inches of steam of 100 lbs. pressure, if expanded to 70 lbs. pressure, will make 4,824 cubic inches. The total heat required to generate 3,446 cubic inches of steam of 100 lbs. absolute pressure from water of 60 degrees is 530.5 units, so that to do the same work by using steam of high pressure cut off at one-third of the stroke, using steam of low boiler pressure full stroke, and using wire-drawn steam full stroke, would, in the example we have selected, require 247.5, 520.4 and 530.5 units of heat respectively.

QUESTION 59. To what extent can we work steam expansively with advantage and economy?

Answer. The theoretical economy of using steam increases with the degree of expansion and the pressure. This is shown very clearly in the following table, in the first column of which the number of inches of the piston stroke is given during which steam is admitted to a cylinder 16 in. in diameter and 24 in. stroke. In the second column is given the pressure of the steam, or initial pressure, as it is called, which must be admitted into the cylinder in order to produce a mean pressure of 70 lbs. per square inch when it is cut off at the point indicated in the first column. In the third column is given the total heat which is required to generate the steam required in each case, and in the last column the percentage of saving is given which results from the different degrees of expansion and a mean pressure of 70 lbs. per square inch in each case.

RESULTS OF USING STEAM EXPANSIVELY.

Period of admission, or point of cut-off.	Initial pressure of steam in lbs. per square inch.	Total heat of steam used, in units.	Percentage of saving compared with full str.
Full stroke.....	70.	527.1	
18 inches.....	72.5	408.7	22½
12 inches.....	82.7	309.5	41¼
8 inches.....	100.	247.5	53
6 inches.....	117.4	215.9	59
4 inches.....	150.5	186.5	64½
3 inches.....	181.8	165.8	68½
2 inches.....	241.4	144.8	72½

From this table it will be seen that theoretically 22½ per cent. of heat is saved by cutting off at ¾ of the stroke and using steam of 72.5 lbs. pressure instead of steam of 70 lbs. worked full stroke. Cutting off at half stroke and using steam of 82.7 lbs., 41¼ per cent. of heat is saved, and cutting off at quarter stroke with steam of 117.4 lbs. saves 58 per cent. of heat; and at one-twelfth of the stroke, or expanding steam of 241.4 lbs. pressure to twelve times its volume, saves 72½ per cent. of heat.

As stated before, the above is the theoretical advantage of using steam expansively. There are, however, practical difficulties in the way of using some of these high degrees of expansion. It has already been explained that if steam is cut off early in the stroke and the degree of expansion increased, the pressure and consequently the temperature of the steam must also be increased. The danger of explosion is greater with the higher pressures, and stronger and more expensive boilers and machinery are therefore needed. With steam of very high temperature, the metal of the cylinders, pistons and valves become so much heated that they soften, and then the friction of the one on the other causes them to cut or scratch each other. The high temperature at the same time destroys the oil or other lubricant used in contact with the steam. It is also impossible to admit and cut off steam very early in the

stroke with the ordinary mechanical appliances used for moving slide-valves of locomotives. This latter difficulty will be more fully explained hereafter.

Contributions.

Bridging the Detroit River.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The New York Tribune of the 30th of January last, in an editorial, commenting upon the report of the Board of Engineers on the bridging of the Detroit River, finds in that report matters for satisfaction which do not appear so obvious to the many.

For, even if during eight months, more than 20,000 vessels having masts pass through the channel of the Detroit River, as they are always towed four or five at a time, it is equal only to less than one passage per hour. A drawbridge, if in existence there, would at the utmost be rendered unserviceable for railroad use only one-fifth of a time, and this during the season of navigation; as a perfect signal service could be very easily established, one fails to see how vessels would ever be delayed in their voyages.

The statement that "9,000,000 tons of freight is asked to yield its interest to one-thirtieth that amount" cannot be taken as a fair representation of the facts, as it seems next to impossible to understand how the exceedingly small amount of extra vigilance required from the boatman can be tantamount to "yielding interest," and it will certainly not convince the thousands of travellers, (who, in the comparison, if estimated at all, are reckoned in tons!) for whom the crossing on ferries is always attended with a good deal of annoyance and discomfort, and when delay occurs is often cause of connections missed, with accompaniment of loss of time and money, both very valuable to most of us.

An unusual amount of solicitude for the railroad interest is evinced when the report condemns as too expensive schemes otherwise "no serious impediment to the navigation." One might have been satisfied with a mere statement of certain conditions required from the bridge, so that it would not seriously interfere with the navigation, the alternative of complying with said conditions or of returning to the abandoned tunnel scheme being left entirely with the interested railroads. Drawbridges leaving waterways of more than 350 feet in the clear have been constructed; if required much larger distances could be spanned; and if modes to-day in use are objectionable, it is not to be doubted that modern engineering can solve the problem in another and satisfactory manner.

Certainly the majority among the interested ones would, on the contrary, be pleased to see the railroads increasing at a reasonable cost their carrying capacity, the need of which is forcibly demonstrated by the fact, quoted in the Tribune, of higher rates standing when the navigation is at rest. At the same time it would appear more conformable to equity, as generally understood, to allow in this, as in all cases of conflicting interests, a proportional division of inconveniences as well as of advantages.

Estimating Cost of Freight Transportation.

PHILADELPHIA, January 24, 1874.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In reply to your query I would say that several years since I made a careful analysis of the various items of total annual cost charged to freight expenses by several of the most ably managed railways in the country, with the view of determining what proportion of such total cost did, and what did not, vary with the volume of business done. I never printed the results, nor could I now furnish them in a useful shape without considerable labor. Moreover, I think them somewhat unsafe present guides, inasmuch as later railway management has introduced many modifying elements, such as larger engines, stronger and more fully loaded cars, ampler trade, and in many cases better balanced currents of trade. These features secure the movement, with any given train force and track, of a much greater number of tons per train mile than could have been accomplished ten years since. Therefore, though the cost of the item of train service, for example, could be fairly supposed to ordinarily increase directly as the traffic, it will readily be seen that its cost per ton per mile must have been larger ten years ago than it now is.

For approximate results, I have been in the habit of using the total annual average cost per freight engine mile as the safest criterion. Thus, in 1872 the entire amount of expenses charged by the Pennsylvania Railroad Company to their freight business, when divided by the total number of miles run by their freight engines, showed a result of one dollar and a half cent (\$1.00½) per engine mile—this including motive power, maintenance of track, of cars, of buildings, general expenses, taxes, agencies, train-men, and everything that was not charged to the passenger business.

To ascertain how cheaply freight could be moved, it would be needful to consider in connection with the cost per train mile, many other circumstances, as each shipment or class of shipments may have peculiar features of its own.

The leading differences in circumstances arise from:

First. Quantity and regularity of movement.

Second. Currents of trade; that is, whether the particular freight to be estimated for is to go in the direction taken by the greatest volume of trade or in the direction in which cars are running empty.

Third. Gradients; which limit the number of tons that can be hauled per freight-train mile.

Fourth. Distance the freight is to travel. If it is to be dropped at some point short of the terminus of the regular run of the engine, the gross expense per ton will be almost the same as though it had been hauled to the point where the locomotive's daily work ceased.*

To illustrate: A shipper who would agree to furnish enough

tonnage daily for a term of years to fully load as many cars as a standard locomotive of the Pennsylvania Railroad Company can haul over a grade of 26.4 feet per mile, and should do this in each direction and between points embraced by the ordinary daily run of a freight engine (say 100 miles), the cost to the company would probably not exceed 3-10 of a cent per ton per mile.

To this price the company would need to add a sufficient sum to make them a fair profit.

This, of course, is so extreme a case as to be an almost impossible one; but it illustrates the method I would pursue in determining the minimum charges consistent with just profits on any considerable shipment or series of shipments.

You will readily perceive that an endless variety of cases, requiring an equally endless variety of arrangements, could be imagined, if the foregoing basis should be generally adopted.

In a very rough way, the better order of railway officials do substantially operate their roads for all large masses of traffic on an approximation to this policy.

If this policy be equitable, and I think no other is equally so, all legislative attempts hitherto made to equalize rates have been not only unwise but extremely unjust to shippers.

JOSEPH D. FORMS.

Telegraph Poles as Distance Indicators.

TO THE EDITOR OF THE RAILROAD GAZETTE.—Your correspondent ("W. P. S.") has, as he thinks, formed a correct idea of the capacity and intelligence of ordinary train-men and discovered a remedy for, or protection against, their stupidity or "universal desire to keep as near the train as possible," by using the telegraph poles along the line to compute distances, and cites his own experience when Superintendent.

With this system we find no fault, but commend and approve it; and to show that "W. P. S." is not the only railway manager that has adopted such a system, I quote extracts from the train rules of the Atlantic & Gulf Railroad, of Georgia, where the system is in constant use and has been for a long time, and where it has given general satisfaction, being at all times accessible and perfectly reliable.

Train rule No. 15 reads:

"15. Whenever a train is proceeding under circumstances requiring the utmost caution, its speed must not exceed four miles per hour. The engine whistle must be frequently sounded, and a signal man must be kept one-fourth of a mile, or the distance between six telegraph poles, in advance."

Train rule No. 17 reads:

"17. While any work is being done to the track that renders it unsafe for the passage of trains, the person in charge of the work must, personally, attend to the placing of dangerous signals, eight hundred yards, or the distance between ten telegraph poles, on each side of the work."

Train rule No. 29 reads:

"29. In cases of detention of a train on the Main Line, whether from accident to the train or defect in the track, the conductor must at once place danger signals at least eight hundred yards, or the distance between ten telegraph poles, in both directions, and see that they are kept in full view for approaching trains until his train can proceed."

The Atlantic & Gulf is the only road that I now know of that uses this system of computing distances.

This road has some other train rules peculiar to it, and not in use on any other in this section of the country, that may be noticed at some future time. SOUTH.

Copy of a Circular Issued by the Grand Chief Engineer of the Brotherhood of Locomotive Engineers.

We have received two copies of the circular below, one in manuscript from a railroad officer, and the other in a printed circular which has been sent to nearly all general superintendents in the country:

CLEVELAND, Ohio, January 2, 1874.

To the Officers and Members of Sub-Division No. —
BROTHERS: A crisis has arrived in the affairs of the B. of L. E. Wages have been reduced on many of the principal railroads in the country, and the members of the Brotherhood generally complain that the reduction that has taken place in their wages is unnecessary. Two strikes have already occurred on account of a reduction in wages; the last one on the leased lines of the Pennsylvania Central Railroad has been managed with an avowed object to disregard all rules of the B. of L. E., and open threats have been made by many of our members that they would break up the B. of L. E. and organize a new one.

With this open mutiny existing, your Grand Chief felt it to be his duty to denounce the men that were engaged in an unholy crusade, and to express the opinion that it would not be dishonor for any man to accept a position vacated by a member acting in direct violation of the rules of our Order.

The general feeling among the divisions where wages have been reduced seems to be in favor of making a united demand for their restoration.

Your Grand Chief does not think you would be successful if you authorize all divisions and members that have been out to join in a strike at some future time; nevertheless he is willing to assume his share of the responsibility, if the divisions will give the authority to make the trial.

The reduction made is generally ten per cent., and we presume our members would be generally satisfied if they could obtain a restoration to prices received before the panic. The appeals for help are so numerous that it would be impossible to submit them separately.

Therefore we ask each Sub-Division to vote on the question: "Will you authorize each and every Sub-Division and member of a Sub-Division to demand the restoration of their pay upon a given day, (to be agreed upon hereafter), to the same rate they received before the panic or the late reduction?"

If you vote to authorize this demand, we propose and advise that all keep quietly at work, but in any attempts to reduce wages that you use all peaceable means to prevent a reduction, and that you all continue your efforts in a peaceable manner to obtain a restoration, but in cases where all your efforts fail, and you wish to make the demand as authorized by all the sub-divisions, you will so inform the Grand Officers at this office, and when two-thirds of the divisions affected by the reduction signify their wish and readiness to make the demand, the Grand Officers will designate the day for them to do so, and notify the divisions accordingly. No division will be obliged to strike after they obtain authority to do so. Each will be governed by the circumstances of their case, and act upon their own judgment.

Our advice is to wait until business generally revives, and

to be cautious in all your movements, as a failure would bring sore distress on thousands, and the utter ruin of our organization. Each Division will please give this circular their immediate attention, and call special meetings, if necessary, to act upon it. At the same time use every effort possible to obtain the vote of as many of your members as can be reached, and report to this office at once.

Brethren, we urge you not to think lightly of an organization that has now the proudest name any labor organization ever bore. Join hearts and hands like men, insisting upon a strict observance of all our rules, and renewing our pledges to each other for unity and success.

Our idea is that persistent effort in a manly way, combined with the influence of prominent men taking a deep interest in our organization all over the country, will eventually obtain more for us than any combination can by force.

We must not overlook the fact that if we are able to compel railroads by force to accede to our terms, that we then shall be able to demand and obtain all their earnings if we desire to do so. Let us be reasonable and judge carefully as to the best policy to pursue. (Signed),

CHARLES WILSON, C. G. E.
E. S. INGRAM, A. G. E.

The Massachusetts Report on the Regulation of Railroads.

The Report of the Massachusetts Railroad Commissioners, just published, has the following chapter on the relations of the State to the railroad:

THE GENERAL RAILROAD DISCUSSION.

More public attention than ever before has, during the last year, been given to the nature and extent of the relations existing between governments and railroad corporations. This has especially been the case in America, where most unusual activity, and, at times, an unnecessary degree of temper have characterized the discussion and consequent political action. While the burden of the discussion has related to the unsatisfactory character of these relations, the tendency of political action has everywhere been towards their closer definition, and the drawing of the machinery of transportation more and more within the range of government control. Not the least noticeable feature of the agitation is the fact that it has been mainly confined to this country and to Great Britain. In Great Britain it has led to the creation by parliament of a board of railway and canal commissioners, which is apparently designed to act as a special tribunal having cognizance only of certain questions arising between railroad corporations as among themselves, or between them and the community. In America it has resulted in prolonged legislative debates and inquiries, in the passage of numerous laws, and, in certain States, in the framing of new constitutional provisions.

It may be assumed that, as a result of forty years' expenditure of capital and labor, the general work of railroad construction is now completed in its larger aspects; or, in other words, the more civilized countries of the earth are supplied with improved highways sufficient for their immediate wants. To the work of construction has succeeded the question of adjustment; an enormous mass of machinery, social and economical, is assuming its relations with the political systems into which it finds itself incorporated, and is necessarily exercising a very disturbing influence upon them. The amount of this disturbance seems closely proportioned in different communities to the degree in which their railroad systems were, in the beginning, established upon a reliance for an even operation on general economical laws alone, or upon government supervision or control. It would seem to be much greater in the former case, and less in the latter. This arises from the fact that all the communities which sought to base the regulation of their railroads upon the economical laws are in some way, and whether consciously or unconsciously, trying to abandon that ground and get upon some other.

It may now be taken as very generally conceded that railroads are, and from the very nature of things must always remain, practical monopolies—that the operation of the law of competition as affecting supply and demand can exercise a very limited control over them, and that even this limited control is rather of a disturbing than of an equalizing character. The supply of competing railroads is not and cannot be indefinite; nor does the increase in their number tend to diminish the cost of transportation; nor, when unprofitable in one place, can they be moved to another; nor, can any excess of capital invested in them be released at will and otherwise used; nor can they be made to feel the influence of competition equally at all points which they serve. Competition is, however, made up of these very elements here wanting; it is their presence which supplies its effective, regulating force to the operation of the natural laws of supply and demand. The popular mind has been slow to realize that they were here wanting; but, once the obvious fact is conceded, it follows that all the dealings of railroads with the community must either be unregulated, except by the intermittent action of a disturbing force, or else that they must be carried on under a greater or less degree of governmental interference. Very naturally, therefore, the character and degree of this governmental interference are most actively discussed in those countries which originally organized their railroad systems upon the assumption that no such interference was necessary. Of these countries America was that one which carried its reliance upon economical laws the furthest. It is in America, consequently, that the work of re-adjustment is accompanied with the greatest amount of difficulty.

As yet, human ingenuity has devised but four methods of establishing the relations in which the railroads of any country shall stand toward its government. Left wholly in the hands of private individuals, or of corporations, they may be independent of all government control, standing on the same footing as cotton-mills or iron-foundries; or, they may be subjected to the operation of special municipal laws establishing their obligations, regulating their charges and limiting their profits; or, still remaining the property and under the control of private parties, they may be subjected to an executive supervision and control; or, finally, in whole or in part, they may be owned and operated by the State. In fact, a species of natural law of political evolution governing transportation by rail may now be formulated. In all countries, the political systems of which are based upon the principle of non-interference in industrial enterprises, railroads are first organized on the theory of their sufficient regulation by natural laws. From this incipient stage they develop through an attempted regulation by legislative enactment into a state of practical executive supervision; the whole process tending, with a greater or less degree of friction, towards the final result, in which the work of transportation by rail must apparently be recognized as one of the functions of government. This process of evolution may now be studied in different civilized countries in each of its several stages. In certain parts of America non-interference is developing into an attempt at legislative regulation; in other parts of the country and in England legislative regulation is passing gradually into the phase of executive supervision, which may be studied in France as a perfected system approximating to state ownership; which final condition again, is in its turn matter of warm discussion both in America and in England, while in Belgium it is already in full development. The gradual and inevitable evolution in this process of development has perhaps been more clearly illustrated in the experience of America than in that of any other single country. For in theory, though not

in law, the railroad corporations of America originally enjoyed an independence of government control common to all general industrial enterprises; they were ordinarily likened to associations for purposes of improved boot-making or baking, and left in their operations to be controlled by the same economical laws. In practice they have been subject to all sorts of special legislation intended to regulate them in their relations to the community. The analogy of the turnpike and bridge corporation, supplemented by the law of common carriers, has been followed; and, for over forty years, the attempt on the part of legislative bodies to frame statutes in the nature of usury laws which would be of some binding force when applied to transportation by rail has been no less incessant than futile. With the greatly increased knowledge on the subject now generally diffused it is sufficiently apparent, not only why such efforts have always proved futile, but why also they always must prove so. As regards fares and freights, for example—the favorite subject for legislation—the framing of a practical railroad tariff, one which will even fairly conform to local and economical requirements, is the most difficult and perplexing task to which the more enlightened and experienced railroad managers are called upon to address themselves. It continually, also, becomes more perplexing and more difficult just as the system grows complex. Yet, until very recently, the idea among legislators has been almost universal that it required only the passage of some simple law, limited to a few sections which almost any one could draw up after an hour's consideration, to regulate the whole subject on a wise, just, cheap and permanent basis. Accordingly the statute books of all the States contain examples of enactments passed in this spirit of confident ignorance. Upon these this Board has had frequent occasion to comment in its previous reports, and their futility is now generally conceded.

In this country, therefore, the relations of the railroad system to the political system may be considered as having now passed through two phases of discussion and attempted settlement—corresponding to two stages in the process of evolution—and to be entering upon a third. It has passed through the non-interference phase and the legislative phase. During the last year it has, in the State of Illinois, entered upon what may be called the phase of executive supervision; while in Massachusetts the discussion has advanced yet further, and has fairly touched its utmost possible limit in the agitation of a measure looking to partial state-ownership.

As an experiment in a direction never before attempted in this country, the movement now going on in Illinois is, therefore, especially worthy of attention. A brief sketch of the recent railroad legislation of that State will not, therefore, be out of place. Originally, Illinois, in at least as great a degree as any other State in the Union, abandoned the whole question of transportation by rail to the natural economical law of competition. Its railroad corporations were organized without any limitation upon their powers, except such as might be deduced from the somewhat vague maxims of the common law. The anxiety of the people to secure the rapid construction of their railroad lines was so great, and their confidence in the efficacy of competition as an all-sufficient safeguard against extortion was so implicit, that they even neglected to retain, as was then the practice in many other States, a legislative power over the charters for purposes of amendment, alteration and repeal. All the early franchises granted in Illinois were accordingly, under the rule of constitutional law laid down in the Dartmouth College case, irrevocable contracts between the people of the State and the corporations to which they were granted. In the course of time, however, and after the railroads were constructed, it became apparent that these natural economical laws, so implicitly relied upon for their regulation, had very imperfect and unanticipated effect. Competition, instead of producing uniformity, cheapness and stability in transportation, led to precisely opposite results; in place of uniformity, it led to gross inequalities between competing and non-competing points; in place of cheapness, it led to alternations of liberality and extortion; and in place of stability, it led to violence of fluctuation. If any effective control over the system was desirable, it became obvious, therefore, that it must be sought elsewhere. Accordingly, when the constitution of 1870 was framed, railroads were especially declared public highways, and the duty of passing laws establishing reasonable maximum rates for transportation upon them was imposed upon the Legislature. Provision was also made in general terms for laws to correct abuses and to prevent unjust discrimination and extortion, with penalties for their violation on the part of the corporations, "to the extent, if necessary for that purpose, of forfeiture of their property and franchises."

Acting under this constitutional authority, the first Legislature which assembled after the constitution of 1870 went into effect, passed certain laws of great complexity, prohibiting, on the ground of unjust discrimination, the charging of the same or a larger sum for doing any work of transportation over a smaller as compared with a larger distance of the same road, and further providing for the classification of the railroads of the State according to their earnings, and the establishing in detail of specific rates of fares and freights for them accordingly. In other words, recourse was had to the system of legislative regulation, pure and simple; and a board of railroad commissioners was created, whose duty it was to see that the terms of the law were complied with. The corporations, however, insisted upon their constitutional rights, and refused to recognize the validity of the statutes. A test case was accordingly made under the provisions in relation to discrimination, and the law was finally decided to be unconstitutional by the Supreme Court of the State. In rendering its decision, however, the court intimated, extra-judicially, that, though the Legislature could not impose upon the corporations specific and arbitrary rules respecting discrimination, or impose fixed rates at which they must perform the work of transportation, yet that the corporations were under a common-law obligation not to discriminate unjustly, or to charge for the services they rendered other than reasonable rates of compensation. If, consequently, a greater rate was charged for a less than for the larger distance, this act the Legislature could make *prima facie* evidence of unjust discrimination; securing the railroad companies a trial by jury not only upon the fact of the discrimination, but upon the question of its justness, or otherwise. It became, therefore, a question to be decided in each case, what rates were reasonable.

At this point the Legislature again took up the work. Meanwhile the brief experience already had under the old law had brought to light very serious defects in it of a most radical nature; so serious, indeed, as to lead to its abandonment on grounds which constituted an abandonment of the whole idea of the control of transportation by exclusive legislative action. It was found that no law could be framed sufficiently flexible to provide in advance for all the requirements of a system so complex as that of modern transportation by rail; some play of discretion to meet individual requirements was absolutely necessary. In other words, the discussion advanced in Illinois, after the failure of the Act of 1871, by one entire stage, and entered upon a wholly new phase; legislative provision had failed and was abandoned, and in place of it, recourse was now had to a system of executive supervision and control. Unconsciously to itself the Legislature was treading the regular beaten path of evolution.

A new statute was passed in May, 1873, which was designed to avoid the legal objections to which the previous act had been open. It was framed throughout upon the principle suggested in the decision of the Supreme Court, that railroad

charges must, under the common law, be reasonable; and that, when unreasonable, they were illegal. The point was to devise a binding test of the reasonableness. This the Legislature itself, under the constitutional limitation put upon its powers, could not do; but it imposed the duty upon the ordinary jury of twelve men. Having thus settled upon a tribunal, the Legislature proceeded to lay down general rules to guide that tribunal. These rules prohibited all unjust discrimination on the part of railroad corporations between parties dealing with them, as well as all acts of extortion on account of any services rendered; and the receiving in any case more than a "reasonable" compensation was to constitute an act of extortion. The law then went on to declare what should constitute in any case *prima facie* evidence of extortion—such as the charging of the same or a larger sum for the carriage of any passenger or equal quantity of merchandise over a less as compared with a greater distance in the same direction; or over an equal distance in the same direction upon no matter what portion of the same road, and without regard to the point of commencement; the charging higher rates as terminal charges at one point than at another, or more to one person than to another at the same point; the charging more to one party than to another for hauling cars from the same point, and for the same purpose, over equal distances of the same road. The Act also provided in terms that it should constitute no excuse for discrimination or extortion that it occurred only at competing points. In addition to these general principles of decision the Railroad Commissioners of the State were further directed to prepare schedules or tariffs for the several roads, which they were empowered to change as might prove to be expedient; and the charges contained in these schedules were to be judicially held to be reasonable, until decided to be otherwise by the verdict of a jury. In other words, the effect of the law was to shift the burden of proof in each particular case of alleged extortion on to the corporation; the schedules of the Commissioners were not declared to be in themselves reasonable, but were declared *prima facie* evidence of what was reasonable, and it devolved upon the defendants to prove that they were otherwise. The further duty of visiting different localities, hearing complaints and instituting suits thereon, which could be discontinued only with their assent, was also imposed upon the Commissioners. Juries were authorized to bring in verdicts against corporations on a preponderance of evidence, and, in their verdicts, they could within certain limits fix the amount of the penalty, which was established on a rising scale for each successive violation of the law.

The law went into operation upon the first day of July, 1873. Although the corporations refused to acknowledge its validity on the ground that it, no less than the previous law, was an infringement of their chartered rights, they declared their intention of revising their tariffs in strict conformity to its provisions so far as they related to the matter of discrimination. Accordingly a new set of tariffs was arranged by them to take effect on the first day of July. The State Commissioners and the friends of the law allege that these tariffs were prepared, however, with a view to rendering the law odious by bringing its oppressive features, where any such could be developed, into prominence. It is not improbable that such was the case; but, upon this point, the Commissioners of Massachusetts have no means of arriving at a conclusion. Meanwhile the Illinois Commissioners, in compliance with the provisions of the law, prepared additional tariffs of their own for the various roads of the State, which, unless otherwise ordered by the Legislature, will take effect upon the 15th of January, 1874, as *prima facie* evidence of what is reasonable. These official schedules have been published, and effect a very considerable reduction from the rates established by the corporations themselves in their tariffs of July 1. It is understood that the corporations do not propose to pay attention to them. The Commissioners have, meanwhile, instituted test cases under the clauses of the law prohibiting discrimination and extortion, and these cases are now pending before the courts.

The legal aspects of the Illinois discussion possess no immediate interest for the people of Massachusetts. With one single exception, all the railroad charters of this State are subject to legislative alteration, amendment or repeal. Accordingly, should the General Court of Massachusetts see fit to pass a law similar to that of Illinois, no question as to its binding force could well be raised. As regards its inherent merits, the law of Illinois is very open to criticism. It is unquestionably a great improvement on the previous law. It is based on more correct principles, in that it seeks to do away with inequality and instability in the cost of transportation, without imposing a forfeiture of franchise as the one penalty for a violation of the Act. It further leaves room for the use of a certain degree of discretion to meet the requirements of individual lines; it does not seek to impose one hard, inflexible rule upon all. But in many respects it is most unskillfully drawn, and reveals, on the part of those who framed it, not only a great lack of familiarity with the important interests they undertook to regulate, but also a noticeable disregard of somewhat obvious economical principles. An examination of the law would seem to indicate that the Illinois Legislature cannot pursue the Massachusetts system of preliminary hearings before committees pending the framing of bills. This system may be open to grave objections, but it certainly prevents the reporting and passage of many ill-considered measures. It is, for instance, difficult to believe that many provisions of the Illinois law could have stood the test of a Massachusetts committee-hearing. In just so far, it is accordingly weaker than it need to have been, and must break down and be amended, even should its constitutionality be sustained.

But, notwithstanding these modifications, it may well be questioned whether the Legislature of Illinois was possessed with an adequate sense of the magnitude, not of the change, but of the revolution it inaugurated by the passage of this law. It was, in fact, nothing less than the sweeping away of the entire basis upon which not only their railroad system had been built up and their transportation carried on, but even that upon which population has distributed itself in their State. All this was now sought to be abolished at a given date, and a new and very different system was to be substituted in its place. Upon the first of July competition as a regulating or disturbing power in the work of transportation was to cease, and a system of graduated rates under State supervision was to take its place. During nearly thirty years it had been the inevitable though unanticipated result of a public policy confidently relied upon and zealously pursued, to concentrate the business of the community at certain competing and consequently greatly favored points. This was the very essence of railroad competition—the obvious and inevitable result of free railroad construction. It could never have been supposed that all points would be supplied with an equal number of competing roads, and, in the absence of governmental restrictions or control, it seemed necessarily to follow that the best supplied points could drive better bargains than others with those who supplied them. The corporations and their methods of procedure were thus the simple and legitimate results of the political system and public policy which had shaped their growth. The difficulty was no surface difficulty, but lay deep down at the base of the economical and political organization of the community. It arose from the misapplication of fundamental economical laws. The true cause of complaint was with a political theory misapplied, not properly with those who, with only too much energy, had carried it out to its logical conclusions. The theory, as is now seen, was a mistaken one, and the system created under it, admirable in many respects, in others produced results both unexpected and wrong—results which the community could not permanently endure. None the less, the policy which was founded on this

theory had in Illinois not only existed from the beginning, but it had been carefully fostered by law. Not only had the business relations of the community conformed themselves to it, but in great degree they were dependent upon it. Yet the laws of 1871 and 1873 at once declared the continuance of the system, so long and so carefully fostered, to be a crime, and visited any recognition of it with heavy penalties. Such a sudden and radical change could hardly do otherwise than work much individual and local hardship at all competing points for at all such the uniform and average tariffs contemplated by the law necessarily implied heavily increased rates. But these points carried on their competition for trade against other competing points beyond the limits of the State and the consequent operation of the law. To them, therefore, the law was productive only of disaster. This complete ignoring of all but one class of existing facts has frequently been noticed in the legislation of other States as well as of Illinois. But it may fairly be doubted whether it has ever advanced the prospects of any desired reform.

This Board has heretofore, in other reports, had frequent occasion to express its opinions on the fundamental principle of the Illinois law (Second Annual Report, 1871, p. 59; Third Annual Report, 1872, pp. 170-74; Fourth Annual Report, 1873, pp. 55-64). That law would seem to inaugurate what may perhaps best be described as a mixed system of regulation. The railroads are primarily referred to the operation of certain natural laws, which in fact have very imperfect application to them; the consequent deficiencies it is then sought to supply through the machinery of the courts. In other words, the hardships incident to a defective political economy are to be remedied by a process at law. The experiment thus attempted necessarily involves a separation between the ownership and the control of railroad property. The property is to continue in the corporation, but the supervision over it, amounting to a regulation, is to be vested in officials of the State. It certainly cannot be said that no system based upon this principle could under any circumstances be successfully carried on. Such a one is, on the contrary, now found successfully operated in France. Indeed, it is a singular illustration of the very narrow limits within which every adjustment of railroad with political systems must be effected, that the Illinois experiment is a crude and apparently unconscious, but yet an almost exact, imitation of the French policy. This latter may be said to be founded on three simple principles: railroads shall not charge more for carriage over a less than over a greater distance; under similar circumstances there shall be no discrimination made between persons; no changes in tariffs shall be effected except after a specified public notice and upon the approval of the minister of public works, who exercises a constant supervision over the operations of all the roads. These are almost exactly the fundamental principles of the Illinois law, with a board of railroad commissioners substituted in place of a minister of public works. Yet the fact that such a system can be successfully administered in France by no means implies its equally successful administration in America. It has there grown up with the gradual development of railroads, and is a part of the political habit of the country. The French civil service has permanence, and consequently is familiar with its business. The railroads are accustomed to supervision, and the community looks to the government for it. The French railroad policy is also thoroughly logical—it is built from the base up. It does not, like that of Illinois, begin with a sublime reliance on the efficacy of natural laws, and end in a jury-box—trying, through the verdict of twelve interested men, to force the results of political economy into a conformity with the eternal fitness of things. The French system, on the contrary, was begun and ends in a denial of the efficacy of competition to regulate transportation by rail. It was originated and built up under the direct supervision and protection of the government. France was distracted among seven great corporations, and these were not encouraged to interfere or compete with one another. Under these multifarious conditions a given system may work well there, but none of these conditions are found in Illinois. It would be wholly premature, however, at present to express any final opinion as to the ultimate success or failure of the experiment in that State. It will have to be judged by its results. Should it accomplish even a part of what its friends hope from it, it will undoubtedly exercise a wide-spread influence over the course of legislation in other States.

While the experiment of executive supervision is upon its practical trial in Illinois, the discussion has made a step further in advance in Massachusetts, where a proposal of partial state-ownership has been agitated. This is the final possible solution of what is known as the railroad problem. As a solution it differs in two important respects from that now being attempted in Illinois. It neither seeks to effect any separation between the ownership and the management of railroad property, nor does it try to establish an arbitrary regulation of railroads, wholly inconsistent with the fundamental principle upon which the railroad system was founded. In Massachusetts, as in Illinois, that fundamental principle was competition, and it is to competition, through the light of experience, that the project of State-ownership, as proposed in Massachusetts, seeks to make the system return. The proposal has been to attempt the regulation of all the railroads of the State, through the public management of one of them. The community is thus to experiment with its own property, and not with that of private parties. Starting from the fundamental position—that competition is the best possible regulating power—far better than the arbitrary decision of any tribunal as to what may or may not be "reasonable"—the theory of partial State-ownership next recognizes as a corollary to this principle the apportionment that where combination is possible competition is impossible. Both reason and experience show that the combination of railroads owned by private corporations is not only practicable, but that it is absolutely necessary to save them from destruction at each other's hands. Competition among railroads beyond a certain point can, indeed, result only in their consolidation. It therefore both has followed and necessarily must follow that either competition as a regulating force will be abandoned and recourse had, as in France and in Illinois, to an executive substitute for it, or else that some competing agent must be introduced into the system so differently constituted from the other members of it that it will not enter into combinations with them. This alien element it is sought to secure through diversity of ownership: a public road competing with private roads. But the end always kept in view is, not the abandonment of competition as the regulating force, but the return to it; it is, on the contrary, that those most reluctant to accept a partial State-ownership who propose the abandonment of all reliance on competition and a recourse to arbitrary regulation.

It has, however, generally been argued that the competition between publicly owned and privately owned roads would be most onerous to the latter; the former it is always, in this case, presumed, being operated in competition, regardless of loss. The reply to this has been, that, presumably, publicly owned roads would always have to pay by their operations a reasonable interest on their cost, or that they would be abandoned in the future as they have frequently been in the past. The argument, however, was certainly specious. During the past summer the Commissioners took occasion to assure themselves of the degree of weight due to it as evidenced by the practical experience of private corporations in the single country in which a systematic competition between public and private roads has ever been carried on. On this point the evidence of those managing the corporation-owned roads of Belgium was most unequivocal. They frankly declared that they infinitely preferred a competition with public rather than with

private roads. And the reason of this preference, as stated by them, covered the whole argument of competition through mixed ownership. They said that the competition of public roads was certain, equitable and justly distributed; that those managing them did not dare to show preference to persons or localities; that they could not make a monopolized local business recoup losses on a divided through business; that consequently the managers of the private lines always knew what they had to expect, and adapted themselves to it; in other words, they were regulated in their operations by the public lines. It was altogether otherwise, they added, as regarded a competition with private lines—that was much more dangerous, and in carrying it on they never knew what to expect; it was violent, wasteful and destructive while it lasted, and no permanent cessation of it could ever be counted upon. In one word, it disturbed operations instead of regulating them.

This was the evidence as regarded competition with a public road of the only managers of private roads who have ever been fairly subjected to it. As such it may be considered as entitled to some weight in the further discussion of this subject, although it was only what was naturally to be expected and what had already been deduced from the general principles involved. It is now no new fact that competition among themselves has been the greatest danger to which private railroad corporations have always been exposed, nor that it has frequently led to violent and sudden changes in their methods of operating their lines very detrimental to those dependent upon them. It was equally obvious on general considerations that those intrusted with the management of public roads could not have recourse to the excessive local discriminations which are necessarily incident to all efforts at competition between privately owned roads. This ground has, however, already been repeatedly gone over in the course of the recent general discussions.

The history of these discussions, as hitherto developed in Massachusetts, is too well known to make any detailed statement of it profitable, and the views of this Board are sufficiently understood. The completion of the Hoosac Tunnel will unquestionably give the subject great prominence during the coming year, as it has given it during the past year. The Commissioners see no occasion to revise or modify any of the opinions they have heretofore officially expressed; on the contrary, their investigations during the past summer have rather tended to confirm them. But the constant attention they have, in the exercise of their public duties, been compelled to give to the subject, has impressed them, more perhaps than most others, with a sense of the difficulties which surround it. They do not, therefore, and cannot, profess an implicit faith in any scheme, no matter by whom advanced, which looks to its immediate and final solution. Neither do they consider it consistent with a correct sense of their official responsibility, to seek to influence the immediate course of legislation, otherwise than by a distinct statement of their opinions when called upon for them. To this line of conduct they propose to adhere. The routine duties of the Board continually increase, and absorb more and more of the attention of the Commissioners. To these they are prepared to devote themselves. Should the Legislature or any of its committees desire to be informed as to their opinions upon subjects of which they may be supposed to have peculiar knowledge or means of forming opinions, they will be ready to respond in the most unreserved way. Beyond this they do not understand that it is incumbent upon them to go. They do not propose to take any part in the discussion as the especial advocates of one policy or of another; they neither consider themselves as partisans, nor are they willing to be regarded as such by others. The questions it has devolved upon them to discuss will doubtless long outlast their terms of office; and, even if this should not prove to be the case, they do not believe that a correct decision would be hastened by any zealous and inconsiderate appeals either public or private on their part.

CHARLES F. ADAMS, JR.,

A. D. BRIGGS,

FRANCIS M. JOHNSON,

Railroad Commissioners.

ANNUAL REPORTS.

New York, New Haven & Hartford.

This company owns a line from Williamsbridge, N. Y., to Springfield, Mass., 124½ miles, all of which is double track; a branch from Berlin, Conn., to New Britain, 2½ miles; from Berlin to Middletown, 10 miles; from Windsor Locks, Conn., to Suffield, 3½ miles; and in Hartford, 0½ miles, making a total of 141 miles owned. In addition to the 124½ miles of second track on the main line, there are 49½ miles of sidings, making the equivalent length of single track 308½ miles. It leases the use of the New York & Harlem track from Williamsbridge to New York, 11½ miles, and it also operates under lease the Shore Line road from New Haven, Conn., to New London, 50 miles.

The operations of the main line and branches for the year ending September 30, 1873, were as follows:

Earnings from:	1873.	1872.
Passengers.....	\$2,899,163 15	\$2,809,144 81
Freight.....	1,468,578 48	1,445,952 00
Mail and express.....	182,141 43	185,640 25
Miscellaneous sources.....	151,392 49	48,816 82
Total earnings.....	\$4,701,285 55	\$4,489,553 88
The expenses were:		
Maintenance of way and buildings.....	703,133 90	.....
Repairs of equipment and tools.....	473,764 56	.....
Fuel and stores.....	307,804 01	.....
Passenger department.....	504,744 61	.....
Freight department.....	422,357 03	.....
General expenses.....	108,212 44	.....
Miscellaneous expenses.....	121,299 78	.....
Total expenses.....	\$2,641,016 33	\$2,385,282 74
Net earnings.....	\$2,060,219 22	\$2,098,271 14
Taxes.....	213,247 38	.....
Interest.....	83,168 55	.....
Hartford & New Haven bonds.....	37,000 00	.....
Balance.....	\$933,416 40	.....
Balance.....	\$1,726,802 82	.....

The year thus shows an increase of \$217,681.67, or 4½ per cent. in gross receipts; an increase of \$255,733.59, or 10½ per cent. in operating expenses; and a decrease of \$38,051.92, or 1½ per cent. in net earnings. The operating expenses were 56.18 per cent. in 1873 against 53.20 per cent. in 1872. The gross earnings were \$38,342 per mile and the net earnings \$14,611 per mile in 1873, against \$31,799 and \$14,881 per mile in 1872. The increase of expenses was caused by the advance in prices of materials, increased passenger train service and increased terminal expenses in New York.

During the year there were carried 3,892,674 passengers, equal to 122,604,308 carried one mile and 895,985 tons of freight, equal to 38,892,498 tons carried one mile. There was a decrease of 1½ per cent. in passenger mileage and an increase of 0½ per cent. in tonnage mileage. The passenger train mileage was 1,143,978 miles; freight train mileage, 481,100 miles, gravel train mileage 223,123 miles, making a total train mileage of 1,848,201 miles.

The equipment consists of 88 engines; 171 passenger and 59 baggage and mail cars; 1,074 freight cars and 250 gravel and other cars.

The operations of the (leased) Shore Line Division for the year were as follows:

Earnings from:	
Passengers.....	\$811,824 13
Freight.....	75,026 32
Mail, express, etc.....	23,380 68
Total earnings (\$8.263 per mile).....	\$910,231 13
Operating expenses (77.54 per cent.).....	\$705,322 83

Net earnings (\$1.855 per mile).....	\$204,908 30
Rent.....	100,000 00
Permanent improvements and additions.....	98,300 00
Deficit for the year.....	106,441 70

The permanent improvements consisted in ballasting a large part of the track; building new approaches to the Connecticut River bridge; rebuilding the long truss bridge at Fair Haven and nearly all the pile bridges; relaying about one-sixth of the track with steel rails; and putting up new station buildings at Saybrook Junction. Some further permanent improvements are needed in 1874, but much less than in the past year.

The main line is now all laid with steel rails, except about 12 miles on the Hartford Division. The whole roadway is now in excellent order, and can be maintained at moderate cost hereafter.

The report is largely occupied with an account of the lease of the Harlem River & Portchester road. This lease, which requires the payment of a rent equal to 7 per cent. on the cost of that road (about \$2,000,000) was made, not with any hope of immediate profit, but in order to prevent the construction of a parallel and competing line from New York to New Haven.

The capital stock is \$15,500,000 (\$109,993 per mile owned) and the bonded debt \$1,059,500 (\$7,518 per mile), besides \$2,000 of past due bonds, payment of which has not been demanded. There is besides a debt of \$65,000 secured by bond and mortgage. The company holds 2,000 shares (\$200,000) of its own stock among its assets. The cost of the road and real estate to the close of the year was \$13,127,171.92 (\$93,101 per mile) and of the equipment \$2,075,711.42.

Grand Trunk.

The operations for the half year ending June 30, 1873, as compared with the corresponding half of 1872, were as follows:

	1873.	1872.
Gross receipts.....	\$898,700	\$869,479
Working expenses.....	687,951	595,416
Renewals of permanent way charged to revenue.....	63,698	70,781
Total expenses.....	\$751,649	\$672,197
Net earnings.....	\$147,050	\$197,282
Deduct loss on American currency.....	9,909	10,636
Balance.....	\$137,141	\$186,646
Postal and Military revenue due to postal bondholders.....	15,900	.....
Balance.....	\$121,241	.....
Interest on hired cars.....	9,630	.....
Honorarium to Mr. Grant, late Secretary.....	1,050	.....
Interest on lands, temporary loans, Bank of Canada, Montreal Seminary and Island Fund debentures, etc.....	13,767	.....
Rents and interest on leased lines.....	95,782	.....
Equipment bond interest.....	30,000	.....
Balance.....	\$180,229	928

The gross receipts show an increase of 3.36 per cent. over 1872, and were for the half year at the rate of \$3,412, American currency, per mile. The increase in passenger receipts was 9.19 per cent., and in freight receipts 0.55 per cent. Operating expenses were 73.21 per cent. of gross receipts, against 68.48 in the first half of 1872. During the half year 761,741 passengers and 772,572 tons of freight were carried, the average receipts per passenger being 68.9d., and per ton of freight, 15s. 8d. The train mileage was 3,292,746 miles, an increase of 12,384 miles over 1872. The cost per train mile was 38.11 cents against 33.36 cents in 1872, the increase being mainly in the items of fuel and wages. The receipts in American currency were \$2,074,856 (nearly 43 per cent. of the whole), of which \$551,800 was converted into gold.

The capital account has been increased during the half year by \$6,031,963. Out of the authorized new issue of \$10,000,000 ordinary stock \$7,500,000 has been offered and subscribed for, the discount and commission on which amounted to \$6,075,000, or 81 per cent. Of the amount realized \$200,000 was appropriated to pay the dividends on the first and second preference stock. The expenditure for new construction and equipment and for changing the gauge of road of 421 miles of road was \$147,248.

Atlantic & Great Western.

The following statement has been published of the earnings and expenses for the year ending September 30, 1873:

Earnings.	
Passengers.....	\$998,414 87
Freight.....	4,134,843 81
Mail.....	42,381 94
Express.....	90,131 56
Miscellaneous sources.....	51,694 35
Total earnings (\$8.874 per mile).....	\$5,818,469 13
Expenses.	
Maintenance of way.....	620,899 31
Maintenance of buildings and docks.....	62,654 16
Maintenance of fences.....	13,609 75
Repairs of locomotives.....	440,877 37
Repairs of cars.....	299,367 80
Station expenses.....	307,174 01
Train expenses.....	1,194,449 26
General operating expenses.....	354,397 86
Salaries.....	150,230 22
Loss and damage.....	54,73 82
Profit and loss.....	609 82
Insurance (\$60) and legal expenses.....	10,092 75
Total expenses (65.46 per cent.).....	\$3,476,592 03
Net earnings (\$3.065 per mile).....	\$2,341,877 10

As compared with the returns for the previous year, there is a decrease of \$136,410.77, or 2½ per cent., in gross earnings; a decrease of \$1,116,697.62, or 24.5-16 per cent. in expenses, and an increase of \$980,296.85, or 114.9-16 per cent. in net earnings.

Railroad Manufactures.

The Allegan Car Company's stockholders held a meeting recently at Allegan, Mich., and resolved to finish up the shops and put in the machinery at once, and then to commence the manufacture of cars.

The Watson Manufacturing Company at Paterson, N. J., has completed during the past month 20 spans of 76 feet each for a bridge over the Rio de Chicama, in Peru. Ten spans remain to be built. The shops have worked enough on hand to keep a full force employed for two months to come.

The Mansfield Machine Works at Mansfield, O., are now in the hands of the company again and work was resumed, February 10.

The Ridgeway Iron Works at Youngstown, O., have been improved by the addition of a new 175 horse power engine and some new tools, and will shortly resume work. The capacity of the works is now 125 tons of finished rails per day of 24 hours.



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Editorial Announcements.

Addresses.—Business letters should be addressed and drafts made payable to THE RAILROAD GAZETTE. Communications for the attention of the Editors should be addressed EDITOR RAILROAD GAZETTE.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

THE THREATENED STRIKE OF LOCOMOTIVE ENGINEERS.

We have received from two different sources copies of the circular addressed to the various sub-divisions of the Brotherhood of Locomotive Engineers, which we publish on another page. How it was obtained, we cannot even guess, but there are "internal evidences" that it is genuine, the language and the sentiments being familiar to those who have been accustomed to read the publications of the Brotherhood.

At the same time we received the second number of the *Locomotive Engineers' Advocate*, a weekly paper published in Pittsburgh and evidently intended as an organ of that section of the Brotherhood which engaged in the recent unsuccessful strike, and of the opposition to Mr. Charles Wilson, the present Grand Chief Engineer of the Brotherhood, who made a great many enemies in the Brotherhood by denouncing the strikers for their flagrant violation of the laws of the society in beginning the strike without first obtaining the proper authority by a vote of two-thirds of the sub-divisions in their favor. Mr. Wilson, we believe, has made no secret of his opinion that the strikes attempted were unwise under the circumstances and ought not to be authorized; but in this particular he and the other grand officers of the Brotherhood are simply ministerial officers: that is, they have no choice in the matter, but must execute the resolutions of the Brotherhood when they have been duly registered according to its constitution and by-laws. They can, of course, use their influence as seems to them best, and that influence is likely to be very great, especially as their positions as editors of the *Journal of the Brotherhood* enables them to bring their opinions before nearly every member of the Brotherhood, and, indeed, nearly every man who runs or fires a locomotive. But in the case of the recent strike, they were hardly called upon to express an opinion as to the advisability of the action, but only to decide whether they would approve and submit to acts of flat rebellion within the Brotherhood. Mr. Wilson had little or nothing to say in his published opinions as to the advisability of striking, but he denounced the rebellion instantly and unmistakably.

The circular which the chief officers of the Brotherhood have issued, and which we publish in this number, seems to be taken, by some railroad officers at least, as encour-

agement to a strike and a threatening of the railroad companies.

Before interpreting it in this way, however, we should consider the position of Mr. Wilson and the other chief officers of the Brotherhood.

As we have said before, they are ministerial officers, and if the Brotherhood votes by the necessary two-thirds majority of its divisions to authorize a strike, they must either carry out this action of their society and do all they can to make such strike successful, or resign. Before such authorization they can use their influence in opposition, if they please; after it, they can do nothing except to execute the declared will of the Brotherhood. They say that "the general feeling among the divisions where wages have been reduced seems to be in favor of making a united demand for their restoration," which is the real reason why the circular is issued; but the next sentence says: "Your Grand Chief does not think you would be successful if you authorized all divisions and members that have been out to join in a strike at some future time." Indeed, the whole tone of the circular is opposed to a strike: "Our advice is," the circular says, "to wait until business generally revives, and to be cautious in all your movements, as a failure would bring sore distress on thousands, and the utter ruin of our organization;" and again, "Our idea is that persistent effort in a manly way, combined with the influence of prominent men taking a deep interest in our organization all over the country, will eventually obtain more for us than any combination can by force." Still it is true that the Grand Chief "is willing" to assume his share of the responsibility if the divisions will give the authority to make the trial of a strike.

A great deal of indignation has been exhibited at the last paragraph of the clause, which follows the statement that "persistent effort in a manly way," etc., "will eventually obtain more for us than any combination can by force." This paragraph is as follows:

"We must not overlook the fact that if we are able to compel railroads by force to accede to our terms, we then shall be able to demand and obtain all their earnings if we desire to do so. Let us be reasonable and judge carefully as to the best policy to pursue."

Now, if we are not mistaken, the first sentence in this paragraph contains nearly the same language and just the same sentiments which have been employed in efforts to show that the assumption of such ability in the men to make the companies do whatever the men might desire requires such a conclusion, and is therefore absurd. Coming as it does at the close of this circular, after all its arguments in favor of other measures than striking, it is only reasonable to believe that it was intended to indicate that the power of the organization in striking is likely to be exaggerated.

On the whole, the circular seems to us creditable on the part of those who issued it, as having a tendency to dissuade the members of the Brotherhood from hasty or violent measures. It acknowledges a prevailing disposition to strike, and in the face of it counsels a different procedure, at least until the business of the country and of the railroads is better.

But the circular may well excite the apprehension of railroad managers, and indeed of the whole community; for it contains the confession that there is quite a general desire to strike on the part of those who have had their wages reduced, and this confession comes from those who are opposed to this desire, and so are not likely to acknowledge its general existence without convincing proof; while their position is such that they must know better than any other men living what the feelings of locomotive runners are. In short, it seems not only possible but even probable that the general convention of the Brotherhood to be held in Cleveland next week may result in a great strike or series of strikes which, whatever their issue, cannot fail to be very disastrous to the railroad companies and the whole community. Such a strike would be a public calamity, and every possible effort should be made by both parties and by the public generally, which is more deeply interested than it well can be in a strike of any other interest, to avoid it.

Now, as all our readers know, we believe that striking is one of the "inalienable rights" of railroad men and all other men; that is, that every man has a right to say whether he will work for the wages offered him, and that any class of men may combine to secure the best terms possible for their work, and that when employers are unreasonable in their requirements, employees may justly refuse to work in order to prevent their employers' property from earning money, and thus make it unprofitable for the latter to insist on their unjust requirements. But the difficult question, and the one which must be solved for each case separately and with a complete understanding of all the circumstances, is: *When is a strike justified?* And though we can by no means pretend to the full knowledge of the circumstances required to decide this question in this case, we may perhaps state some of the reasons which should influence the railroad companies and the engineers as to the course which they shall pursue.

And first, as to the companies. Doubtless their officers have not made reductions in pay without consideration, but it by no means follows that they were always right, or

that a reduction made two or three months ago is necessary or justifiable now.

We hope it is not necessary to enlarge upon the importance of the services of locomotive runners, or the reasons why they should be a superior class of men, and therefore should be and must be paid good wages if they are to be kept in this service. But having seen their business spoken of slightly, it may be well to call attention to the fact that these men must have, to be efficient:

1. A high degree of ability, mental and physical.
2. A high degree of moral character, and
3. A high degree of training and skill.

Now there are those who will disagree with us on each of these three points; but we are sure it is because they do not fully appreciate the full meaning of "ability," "skill," and "moral character."

First, as to ability. It is true that a locomotive runner need not be a good scholar; he may even be slow to learn and yet be a most excellent runner. But there are other abilities than those which shine most at school, and among those which a good locomotive runner must have a large share of are:

1. The power of long continued and unwearied attention, that he may be able to watch the road and his engine without the slightest relaxation during the longest possible trip.

Now this is indispensable to the safety of the road, but it is not a universal quality, not even a common one, and in a high degree it is even a rare one, seldom found except in those in whom it has been developed by long service of this kind. And it is a quality which not every man can exert at will. Most of us would absolutely become incapable of giving exact and constant attention after riding on a locomotive six or eight hours, and no more able to perform that duty than we are to listen when we are half asleep.*

2. Akin to this is alertness of mind, which makes us alive to the slightest occurrences within reach of our senses, and is often strikingly developed in hunters, who will see and hear in a dense thicket a hundred things which most of us would never perceive. Any man who has had the charge of sentries and outposts in time of war will testify as to the great differences in capacities in this respect.

3. Endurance, both of body and mind, which in case of accidents and delays is often tested to the utmost. No man easily worn out has any business with running locomotives.

4. Sharpness of sight, power of distinguishing colors of signals, and soundness of hearing, and generally that perfection of the senses which enables one to observe accurately objects at a distance.

5. Energy, decision and presence of mind, the absence of which in a runner will probably cause him to lose a train or a life or many lives in the course of his service. These are, however, moral as well as mental qualities.

Again, as to moral character. We do not, of course, mean religiousness. We do not even say that all morality is required of engineers; that they must necessarily be above the average in honesty, truthfulness, reverence, benevolence, etc. But we do mean to say that they should, every one, have a profound sense of duty, and capacity for making any sacrifice in doing that duty, even to laying down life itself; and we know that there have been thousands of proofs of the existence of that sense of duty in this class, and not a few examples of engineers who have risked their lives, yes, and lost them, in obedience to that sentiment. And it exists, too, among men not otherwise admirable—profane, perhaps, violent, careless and willful, but yet capable of the supreme sacrifice when duty clearly demands it. This conscientious devotion to duty is demanded of every man who runs a locomotive; it is, we need not say, anything but a common quality, and it is, moreover, a marketable quality; that is, men who have it, and are known to have it, are in demand at good wages for various positions of trust.

We claim, therefore, that taking men as "raw material," without reference to training, we need to sift them carefully in order to get the stuff which will make the right kind of runners to put in charge of locomotives.

Finally, as regards training and skill. There is a disposition to decry the degree of these possessed by the locomotive runner, probably because the best of them may be comparatively awkward and inefficient in the use of tools in the shop, which is much as if we should accuse a dry-goods salesman of a lack of skill because he could not mend his scissors, though he knew every variation in shade and texture in the goods he handled, and sold them readily. The runner's chief tools are his engine, the cars, and the road, with its not too simple accompaniments of switches, sidings, signals, stations, etc. The *working* of the engine under the circumstances existing on his road is his great trade, in which the chief demand is made on his

* If any one doubts this, let him get on a locomotive at 10 o'clock at night and ride until morning. We doubt whether there are many people unaccustomed to this experience who would not find themselves unable, from sheer exhaustion, to recite the multiplication table correctly at the end of the journey. Most of us would be completely "used up" by two day runs and two night runs the same week, which often fall to the lot of the locomotive runner.

skill; the temporary repairs which he must be qualified to make require of him quickness and a thorough knowledge of the machine, and doubtless even more skill than he can attain, and the extraordinary measures to be taken in case of accidents of themselves require a kind of skill which scarcely anyone else possesses and is by no means easily acquired. Few skilled mechanics have so imperative a need of a certain degree of skill, for the runner has a very costly and complicated machine under his sole care, without supervision, from the beginning to the end of his trips, and a little ignorance or negligence can make sad work of it between the two engine houses.

To do justice to the requirements of the work of running a locomotive and the many things in which it demands a high degree of skill would require, however, a treatise rather than a paragraph; but the difference between a skilled and an unskilled engine-man may be easily (though expensively) found by permitting one of the latter to run an engine. The difference in the accounts for repairs, fuel and oil will be sufficiently convincing, even if no great disaster comes to add to the impressiveness of the lesson.

Indeed, the fact that in the midst of free competition, with the career open to almost every man who will attempt it, the natural result has been a scale of wages in this employment twice as high as that of the lower grades of trainmen, is of itself sufficient evidence that rare qualities of some kind are required of these men.

This is saying a great deal in order to show what no railroad officer ought to question: namely, that locomotive runners deserve to be classed with skilled workmen, who cannot possibly be quickly or efficiently replaced except in that condition of the labor market when the supply largely exceeds the demand. And this railroad managers should not fail to bear in mind: that unless there is now evident such an excess in the supply, which they can pretty well judge by the number of applications for engines which they are receiving from trained runners, any event which will cause them to lose the services of their present men will be almost sure to bring disaster, either from prolonged inactivity or from the loss and damage caused by unskilled men.

Still it doubtless often happens that those who control the finances of railroads have very little knowledge of the duties of locomotive runners, and in issuing orders for a wholesale reduction of expenses may lose sight of all else excepting the prospect of net earnings. The possession of capital gives a great deal of power, which, as we nearly all have occasion to know, is often exercised arbitrarily and unjustly. The men who own the stock of a railroad in Minnesota can meet in an office in Wall or William street in New York and issue an order which will touch the homes and lessen the comforts of hundreds and thousands in their employ whom they never saw nor care to know. Now we do not say that such an order may not be necessary, but we do say that when the receipts of a road decline, the ease and facility with which wages can be reduced by the exercise of the power which capital gives often leads to a reduction of expenses by lessening the pay of men, when it would be much wiser and juster to cut down expenses in other directions. If, for example, purchases and contracts were scrutinized more closely, and if the bribes and the profits which sometimes mysteriously accrue to minor and to major officers were turned into the treasury of the company, it might be less necessary to reduce the compensation of men who, in earning it, now perform so much labor, endure so much hardship, and encounter so much danger.

On the other hand, the men should understand the position which they occupy and the circumstances of the times in which they are acting. We have endeavored above to justify their claim to a high rank among the employees of railroad companies and to pay corresponding to that rank. But it is unquestionably true that they are given a comparatively high place and pay. Whether either is high enough it is almost impossible to say; for if such things do not settle themselves they are rarely settled at all. Scarcely any of us think that we are rewarded in proportion to our deserts; but the price paid for our services depends chiefly on the number of those who are willing to render similar services and on their necessities. Supply and demand regulate engineers' wages as well as other prices. Now we wish to call attention to the fact that for several years past and until very recently the circumstances of this country have been such as to make it probable that the demand for men to run locomotives has been unusually and unnaturally great. The natural increase in the demand for such men is that caused by the increase in the production of the materials to be transported and in the distances which they must pass over. There is a constant increase of these; for the country grows constantly, and most rapidly in agricultural districts which are distant from their markets. But of late years there has been an increase in railroads and in the locomotives used on them entirely out of proportion to the increase in the whole amount of transportation. When the Pennsylvania Railroad adds an engine to its equipment, that engine has all it can do from the first: but when a little road on the Western prairies is completed, and usually for some years

RAILROAD EARNINGS IN JANUARY, 1874.

NAME OF ROAD.	Mileage.					Earnings.					Earnings per mile.				
	1874.	1873.	In.	Dec.	P. c.	1874.	1873.	Increase.	Dec.	Per c.	1874.	1873.	Inc.	Dec.	Per c.
Atlantic & Great Western.....	571	539	32	6	1%	\$ 408,039	\$ 374,719	\$ 33,320	8%	8%	\$ 715	\$ 695	\$ 20	2%	2%
Atlantic & Pacific and leased lines	738	709	29	61	7%	341,996	319,647	22,349	7%	7%	463	400	63	15%	15%
Burlington, Cedar Rapids & Minn.	424	334	90	27	8%	106,303	61,136	45,167	74%	77%	253	183	70	38%	38%
Chicago & Northwestern.....	1,430	1,404	26	1%	1%	993,490	752,408	241,082	32%	32%	695	536	159	29%	29%
Chicago, La Salle & Vincennes...	167	132	35	19	14%	33,516	47,515	6,001	12%	12%	341	360	19	5%	5%
Cleveland, Col., Ctn. & Indianap.	470	470	0	0	0%	366,943	356,382	10,561	3%	3%	781	758	23	3%	3%
Erie.....	971	971	0	0	0%	1,462,650	1,326,508	136,142	10%	10%	1,506	1,366	140	10%	10%
Illinois Central.....	1,109	1,109	0	0	0%	611,491	602,241	9,250	1%	1%	551	543	8	1%	1%
Indianapolis, Bloomington & W.	344	319	25	7%	7%	182,129	100,326	81,794	81%	81%	442	315	127	40%	40%
Lake Shore & Michigan Southern.	1,174	1,136	38	3%	3%	1,819,749	1,445,122	374,627	26%	26%	1,594	1,272	322	25%	25%
Marquette & Cincinnati.....	284	284	0	0	0%	171,028	170,028	1,000	0%	0%	602	599	3	0%	0%
Michigan Central.....	787	715	72	10	14%	647,476	478,898	171,578	36%	36%	823	596	227	38%	38%
Milwaukee & St. Paul.....	1,236	1,121	115	10%	10%	654,400	334,715	319,685	95%	95%	574	299	275	92%	92%
Missouri, Kansas & Texas.....	784	641	143	22%	22%	257,600	200,639	56,961	28%	28%	329	233	96	41%	41%
Mobile & Ohio.....	517	517	0	0	0%	293,927	312,848	18,921	6%	6%	569	605	36	6%	6%
Ohio & Mississippi.....	393	303	90	30	9%	265,575	277,146	11,571	4%	4%	675	705	30	4%	4%
St. Louis, Alt. & T. H. Main Line.	266	266	0	0	0%	99,724	178,925	6,201	5%	5%	375	396	21	5%	5%
St. Louis & Iron Mountain.....	310	288	22	8%	8%	156,700	146,161	10,539	7%	7%	544	443	101	23%	23%
St. Louis, Kansas City & Northern	507	585	78	13	2%	177,331	189,553	12,222	6%	6%	350	325	25	8%	8%
St. Louis & Southeastern.....	349	349	0	0	0%	111,900	88,126	23,774	27%	27%	321	238	83	34%	34%
Toledo, Peoria & Warsaw.....	237	237	0	0	0%	96,794	79,591	17,203	21%	21%	408	336	72	21%	21%
Toledo, Wabash & Western.....	628	628	0	0	0%	423,343	370,290	53,053	14%	14%	674	590	84	14%	14%
West Wisconsin.....	197	197	0	0	0%	81,369	34,583	46,786	135%	135%	413	176	237	135%	135%
Total.....	13,954	13,500	454	3%	3%	\$9,493,391	\$8,212,138	\$1,281,253	15%	15%	\$ 680	\$ 608	\$ 72	11%	11%
Total increase.....															

afterwards, it not only has few trains, but these trains are not half loaded, and a single passenger engine on the New York Central may easily do more work, counting by the number of passengers hauled one mile, than ten engines on some border railroads. But a locomotive must have a runner when it hauls one coach as much as if it hauled ten. Now the increase of railroads for three years was two or three times as great as the increase in production. The railroads had to be supplied with runners, and their demand made the supply of skilled men unusually small, and naturally brought wages up.

Now all this has changed. Last year little more than half as much road was built as the year before, and this year we are building still less. Evidently the increase in trains and in the men to run them will be only what we have called above the "natural" increase. It is hardly possible that there will be places for nearly so many new engineers this year as last, and unless there has been a sudden great decrease in the number of men fitted to run locomotives there is likely to be a greater number than usual of men "waiting for an engine." But the previous great increase in engineers, each with his fireman, makes it probable that a greater and not a less number of men completed their training as runners last year than for any year before it.

Again, we must consider the general condition of railroad and other business, and of labor generally. We must not forget that the great collapse last Fall affected railroads as well as individuals, that their business and their profits were reduced, and therefore that they were less able than before to pay high wages. All over the country, and in nearly all employments, so far as we know, wages and salaries have been generally reduced. Locomotive runners should keep it clearly in their minds that this condition of things is not caused by the maliciousness or injustice of their employers. It is a penalty which we as a people have brought upon ourselves, and which each one of us must suffer from. It will therefore be the wildest of folly for the members of the Brotherhood of Locomotive Engineers to assert that they refuse to bear their part of the hardship which this condition of things has laid upon the whole community. They may say that they have had no part in bringing these misfortunes upon the community, and therefore should not suffer the penalty. Even if this were true, which we doubt, men who use such an argument have profited very little by experience if they have not learned that we are all obliged to suffer for the wrong doing of others.

But it may be said that the panic is now over, the business has largely revived; and it is no doubt true that several railroad companies have already quite recovered from the effects of the panic and are making as much money as ever. But in every question of this kind we must remember that it is the average condition of the whole business which determines the demand and with it the wages. The Lake Shore may be making greater profits than ever before, but it does not make the labor market any more than it makes the iron market, and it cannot be expected to pay more than other roads for its men, any more than a higher price for its iron; or if it does it is because it wishes to pick its men. It is possible that the half-suspended condition of a hundred or two new roads may overbalance the prosperity of twenty old ones. If so, the supply of men will continue to exceed the demand, and any company will find it easy to get all it wants at less than last year's wages. If, on the contrary, the prosperity of the roads as a whole is as great as it was last year, and they need all the skilled runners they can get, then they ought to pay as much as they did last year, (unless they paid too much then, which we do not believe, notwithstanding the unusual demand then); and they probably will have to, and not only the prosperous companies, but the unprosperous ones and even the numerous bankrupt ones, which cannot expect a man to sell them his services at 1.88 than the

market price, any more than they can expect a manufacturer to sell them his iron at less than the market price, by reason of the buyer's poverty.

The Brotherhood should bear in mind that striking or submission to the existing condition of things are not the only alternatives. Should its representatives decide at the meeting next week that a restoration of wages to the old standard is their just due, they may, we believe, do something better and more effective than the authorization or ordering of a strike. They might, for instance, issue an address to the railroad companies of the country, and state in it their grievances and the difference of opinion existing between them, and offer to submit their differences to a board of arbitration, and to abide by its decision. This would at once enlist public sympathy and confidence in their organization and its objects. This sympathy and confidence they cannot afford to sacrifice or lose, which they certainly will if they break their own rules and refuse to keep strictly their plighted faith.

In this connection we heartily commend the following admirable address of some of the English colliers on arbitration, which is a manly, straightforward statement of the relations of the men to their employers, one which does its authors credit, and a model which the Brotherhood could imitate with honor to itself and respect to those whom they would address:

"To the Coal and Ironstone Masters' Association of South Staffordshire, East Worcestershire, and Cannock Chase:
 "Gentlemen—The intelligent miners of the district have observed with interest and satisfaction the progress of conciliation and arbitration as means of peacefully adjusting labor disputes; and as we admire the wisdom and friendliness that has inclined other masters and workmen to prefer the awards of reason and justice to the chance results of injurious trade struggles, we wish for the adoption of these principles in our trade, and for the establishment of a permanent Court of Conciliation and Board of Arbitration for the mining industry of South Stafford, East Worcestershire, and Cannock Chase. Thinking men of all classes are convinced of the folly and waste of strikes and lock-outs, and we desire to take a practical course in order to avoid them, believing, as we do, that the best way—at least, in trade matters—to ensure peace, is to prepare for it. You in your association, and we in our amalgamated union, have both the power to make war upon each other, but in those two organizations we may both also, if we will, have the best guarantee of peace and good will. A combination of masters and a combination of men are both needed, if a strong and useful board of arbitration must be established and carried on. In the Arbitration Act, recently enacted by the Houses of Parliament, the opportunity is afforded to these boards to make all their decisions binding, and as legal as if they were verdicts given in a court of law; there can thus be no objection on the score of the awards not being capable of enforcement. Surely, in this day, in a great trade like ours, upon which so many thousands depend for subsistence, and so many hundreds for their wealth, there cannot be two opinions as to the desirability of this board being formed, and we feel sure that public opinion will powerfully back up our appeal. We do not wish to say it offensively, but modestly, yet firmly, that we claim a right to negotiate the price of our labor with those to whom we sell it, and with the same freedom as the vendor of any commodity in the market. The day is past for either capital or labor dictating terms unconditionally to the other, and the alternatives that are now offered—when by union the two parties are ever on a war footing—are ruinous contests, that squander what both should sensibly agree to divide, or these labor exchanges, where employers and workmen may meet on friendly terms, and strike their bargains. We ask for arbitration as well as conciliation, because we believe that, when the spirit of compromise and concession fails in conciliation, we should not be left without a means of avoiding a struggle. Conciliation without arbitration may fail at any time. We can assure you of the hearty adhesion of the great army of miners in this district to these principles, and sincerely hope that our appeal will meet with a favorable response from you.

"On behalf of the miners of South Staffordshire, East Worcestershire and Cannock Chase,

"CHARLES GETHING.
 "LEVI BRITAIN.
 "THOMAS GRIFFITHS.
 "GEORGE PICKARD.
 "RICHARD COTTERILL."

But should the Cleveland meeting of the Brotherhood authorize a strike, it by no means follows that there must be one. It that case there will be an opportunity for the exercise of reason, discretion and conciliation by the railroad companies. These should still endeavor to avoid the threatened strike. Negotiations with representatives of the men might result in convincing them of the hopeless-

ness of success, if not of the injustice of their claims. And should they fail in this, they might prevail on the men (and themselves) to submit the case to arbitration, and arbitration properly conducted and by fit men would be likely, it seems to us, to settle the question more satisfactorily and on a sounder basis than direct negotiation between the two parties. For such arbitrators could inform themselves more fully than either the Brotherhood or the companies are likely to do of the average degree of prosperity among the railroads, and of the existing and probable demand for men.

Every consideration urges all parties to use every effort to settle the question peaceably. The men would gain immensely in reputation for coolness and good judgment by such a settlement or by reference to arbitrators, and the companies would merit and probably acquire the good will of their men by refraining from anything like arbitrary conduct, by a willingness to explain circumstantially the reasons on which their conduct is based, and by submitting the case, if necessary, to some tribunal whose disinterestedness the men will all acknowledge. As for the community, its interests are probably equal to those of the two parties immediately concerned, and should cause it to exercise all its influence in favor of a peaceful settlement.

Record of New Railroad Construction.

This number of the RAILROAD GAZETTE has information of the laying of track on new railroads, as follows:

Valley of Virginia.—Track is laid from its northern end at Harrisonburg southward 15 miles to Mount Sidney, Va. *Memphis, Carthage & Northwestern.*—Extended from Shawnee west 2 miles to Brownsville, Kan.

This is a total of 17 miles of new railroad, making a total of 82½ miles completed in the United States in 1874.

GOVERNMENT TRAFFIC ON LAND-GRANT RAILROADS was the subject of a pretty warm discussion in the lower house of Congress on the 4th inst., the occasion being an amendment to the Army Appropriation Bill offered by Mr. Holman, of Indiana, providing that no payments shall be made for transporting troops, etc., on any road which has received a land grant on condition that such road "shall be a public highway for the use of the Government, free of tolls or other charges." During the war, when this question came up, the Government officers concluded that this provision remitted only that part of the charge due to the use of the road, and not to the use of rolling stock or conducting the traffic, and it was agreed to pay for Government traffic two-thirds of the ordinary rates. At that time a very large share of the whole traffic, of the Illinois Central, particularly, was Government transportation, and several millions were paid to land-grant railroads for such services. Whatever may be the legal effect of the condition referred to, it is plain that it would be simply madness for any railroad company to accept any such grant with the understanding that it should under any circumstances conduct all Government transportation without any pay whatever. It might easily happen, in case such road should be at the seat of war that very nearly its whole traffic for a year or more would be Government traffic, in which the carrier would not only give the use of its property free, but also pay from its own resources the cost of conducting such traffic, equal on the average to two-thirds of what the public pays for it, and would be compelled, instead of paying dividends, to collect from its stockholders an assessment equal to twice the ordinary dividend, besides a sum equal to twice the interest on its debt, which of course would be utter ruin to any company. In the case of the Illinois Central, for instance, the working expenses and interest on its debt amounted to more than one-fifth of the capital stock, and if all the traffic had been Government transportation conveyed free, an assessment of 20 per cent. for that single year would have been necessary in order to keep the road running and save it to its owners. Of course the Government traffic was not the sole business of the road, but it is safe to say that if the company had been compelled to carry it free during the war, it either would have become bankrupt or been compelled to enormously increase its rates for other traffic.

AMERICAN IRON MANUFACTURES, according to the reports made at the recent convention of manufacturers in Philadelphia, are now fully sufficient, if worked up to their capacity, to supply the country, without any importation of pig iron at least. According to the report of the Secretary of the American Iron and Steel Association, there were at the close of 1873 no less than 650 blast furnaces in the country which were either making pig iron or were prepared to make it. Another society, the National Association of Iron Manufacturers, reported at the same time that these furnaces had a capacity for making 5,000,000 tons of pig yearly. Information received from 385 of these blast furnaces showed that at the close of the year 247, or nearly two-thirds, were in blast. At the same time there were 969 blast furnaces in England, of which 721, or three-quarters nearly, were in blast—the proportion idle being not very different in the two countries. The production of pig in the United States in 1873 was, approximately, 2,695,000 tons, against 2,900,000 in 1872; in England, 6,850,000 in 1873 and 6,742,000 in 1872. The great discrepancy between capacity and production in this country is not due solely to the depressed condition of trade for a large part of the year, but also to the fact that the capacity is largely made up by new furnaces constructed in 1872 and 1873, which have never been in blast, the enormous prices and large profits during the first year having naturally encouraged the construction of an extraordinarily large number of furnaces, some of them, doubtless, in situations where they could not possibly be profitable under ordinary circumstances. The imports of iron of all sorts into the

United States from Great Britain during the year were only 371,164 tons, and these were nearly all the imports; so it appears that our iron-masters now have the trade pretty much in their own hands, the imports of pig having been less than 4 per cent. of the domestic production, and of finished iron about 13 per cent.

The Iron Manufacturers' Association reports the production of rails in the United States to have been 850,000 tons in 1873, while 185,000 tons, or 18 per cent. of the whole consumption, was imported. Taking pig and finished iron together, imports and domestic production together amounted to 5,118,000 tons, 7½ per cent. of which was imported. This, however, of course counts much of the iron twice, the pig having been chiefly consumed in making finished iron.

THE IOWA LEGISLATURE seems inclined to be very "thorough" in its treatment of the railroad question. The net earnings of the lines in that State probably cover the interest charges and a little more, and by a little judicious legislation they can all be brought into bankruptcy quite easily and quickly. Seven bills concerning them have been introduced, most of them limiting charges, besides sundry amendments to the code, such as one compelling all roads to have double tracks in the future; to give the relatives of persons killed by railroad accidents \$10,000 and the State a penalty of \$10,000, also requiring that all stations should be kept open, warmed and lighted at night, etc. This Legislature, we suppose, is pretty sure to pass some law restricting rates, and almost any reduction on some of the Iowa lines is sure to result in bankruptcy.

THE COST OF TRANSPORTATION is the subject of a treatise compiled with a fullness and minuteness of information and a thoroughness of analysis that we have never before seen equalled in the treatment of this subject, which Mr. Albert Fink, C. E., Vice-President and General Superintendent of the Louisville & Nashville Railroad, is about to publish. We have been favored with advance sheets of the part now in print, which covers the subject of transportation by passenger trains. The part on freight transportation will be ready, we understand, in a month or so, and this first part (which we will notice further and give extracts from hereafter) justifies us in expecting a contribution to the knowledge on the subject of very great value, which will be eagerly read by all railroad managers and other students of the subject.

WORKING EXPENSES on the Belgian State Railroads, which in 1871 were 52.03 per cent. of the gross receipts and in 1872, with larger receipts, 59.95 per cent. are reported unofficially, but without contradiction, to have been 78 or 80 per cent. in 1873. An eminent Belgian economist in commenting on this report says that it is "of a nature to injure the reputation of the Belgian administration and even the credit of the State." If true, the net earnings, which were 7.96 per cent. on the investment in 1871 and 5.21 in 1872, have fallen to 3.27 in 1873, and the State will have to pay several millions as rentals of roads worked in excess of their net earnings.

SUITS FOR EXTORTION have been brought by the Illinois Railroad Commissioners against the Chicago & Alton and the Toledo, Wabash & Western companies, the complaint being that these companies have made charges higher than the rates fixed by the Commissioners as "reasonable maximum rates" on those roads. These rates became *prima facie* evidence that higher rates are unreasonable, on the 15th of January. The suit against the Chicago & Northwestern is not founded on this principle, having been brought before these schedules went into effect.

THE MASSACHUSETTS COMMISSIONERS' REPORT for the year ending with September, 1873, is now published, and we copy from it the long and valuable chapter, "The General Railroad Discussion." The report everywhere, so far as we have been able to examine it, fully maintains its position at the head of all literature of its kind, and gives in its statistics as well as its discussions material for many important investigations of railroad economy. We hope to be able to give further selections from it and perhaps some comments in future numbers.

THE METROPOLITAN RAILWAY, the main London underground road, carried 43,533,973 passengers in 1873, or an average of nearly 60,000 each way daily, and its gross earnings for passenger and of freight business were £408,382. For the last half of the year the working expenses were about 46 per cent. of the earnings, and the dividend was at the rate of 2 per cent. The average receipt per passenger was only five cents.

CORPORATION TAXATION is attempted this year in Illinois in a decidedly novel way. All the property of the corporation is taxed as usual, like other property; but in addition the corporation is assessed on its capital stock, which is simply certificates of ownership in that property. This is precisely as if a person should pay a tax on his land, and then an equal amount on the deed for his land.

Transportation in Congress.

In the House, on the 11th, being in Committee of the Whole on the Army Appropriation Bill:

Mr. Cobb's amendment, offered the day before, intended to turn all Government transportation to the Kansas Pacific as against the Atchison, Topeka & Santa Fe, because of the saving made by charging one-half of the price of such transportation on account of the interest due the Government from that company, was lost after a brief debate, in which Mr. Holman, of Indiana, claimed that under the terms of the land grant to the Atchison, Topeka & Santa Fe it is bound to carry Government business without any pay.

In the House on the 16th: Mr. Phillips, of Kansas, introduced, "by request," a bill to enable the Central Branch Union Pacific Railroad to submit its claims against the United States, under the existing laws, to the decision of the Supreme Court.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

—At the annual meeting of the West Jersey Railroad Company in Camden, N. J., February 10, the following directors were elected: Thomas Jones Yorke, Thomas H. Dudley, Camden, N. J.; Samuel A. Whitney, Glasboro, N. J.; H. J. Mulford, Charles E. Elmer, Salem, N. J.; John M. Moore, Clayton, N. J.; Lewis Mulford, Millville, N. J.; Coleman F. Leaming, Cape May Court House, N. J.; Strickland Kneass, Josiah Bacon, George B. Roberts, George Wood, Samuel T. Bodine, Philadelphia. The board re-elected Thomas Jones Yorke President and George J. Robbins Secretary and Treasurer.

—At the annual meeting of the Schuylkill Navigation Company in Philadelphia, February 10, Frederick Fraley was chosen President with the following board of managers: Charles Baber, George Brooke, John N. Hutchinson, Camille d'Inville, Joseph B. Townsend, Charles W. Wharton. The board elected Charles W. Bacon Treasurer and Richard Wilkins Secretary.

—The new board of directors of the Cairo & Vincennes Railroad Company have elected Mr. J. P. Morgan President of the company in place of Gen. A. E. Burnside. Mr. Morgan is a member of the banking house of Drexel, Morgan & Co., in New York.

—At the annual meeting of the Marietta, Pittsburgh & Cleveland Railway Company in Marietta, O., February 10, the following board of directors was unanimously re-elected: A. J. Warner, W. P. Cutler, Samuel Shipman, F. W. Ewart, W. H. Frazier, Isaac Morton, Augustus Wilhelm. At a subsequent meeting of the board the following officers were elected: A. J. Warner, President; Isaac Morton, Vice-President; Samuel Shipman, Treasurer; J. A. Kingsbury, Secretary.

—Mr. George H. Griggs, formerly Master Mechanic of the Flushing & North Side, and later of the South Side Railroad of Long Island, has been appointed General Superintendent of the Keokuk & Des Moines Railway, with office at Keokuk, Ia.

—At the annual meeting of the Dubuque & Sioux City Railroad Company, in Dubuque, Ia., February 9, the five directors whose terms expire this year were re-elected, as follows: M. K. Jesup, Isaac H. Knox, D. Willis James, Frederick Schuchardt, John F. Slater. The road is leased to the Illinois Central.

—At the annual meeting of the Dubuque Southwestern Railroad Company, in Dubuque, Ia., February 9, the old board of directors was re-elected, as follows: J. P. Farley, Dubuque, Ia.; John Crerar, Chicago; M. K. Jesup, D. Willis James, Samuel A. Strang, New York.

—The New Jersey Legislature in joint meeting, February 12, elected Charles A. Butts, of Burlington, State Director of the United New Jersey Railroad & Canal Company for the ensuing year.

—At the annual meeting of the Vermont & Massachusetts Railroad Company, in Fitchburg, Mass., February 11, the following directors were elected: George F. Fay, Thornton K. Ware, Fitchburg, Mass.; Wendell T. Davis, Greenfield, Mass.; James A. Dupee, Walpole, Mass.; Daniel S. Richardson, Lowell, Mass.; Francis Goodhue, Brattleboro, Vt.; William H. Hill, Boston.

—At the annual meeting of the Boston & Albany Railroad Company, in Boston, February 11, the old board of directors was re-elected, as follows: Chester W. Chapin, Springfield, Mass.; D. Waldo Lincoln, Worcester, Mass.; Henry Colt, Pittsfield, Mass.; E. B. Gillette, Westfield, Mass.; Ignatius Sargeant, Ginery Twichell, Brookline, Mass.; George O. Crocker, New Bedford, Mass.; James M. Bebe, Boston.

—The directors of the Western & Atlantic Railroad Company have re-elected Gov. Joseph E. Brown, President; W. C. Morrill, Treasurer, and Gen. William McRae General Superintendent.

—The trustees under the consolidated mortgage, having taken possession of the Toledo, Peoria & Warsaw Railway, have appointed Mr. John Newell, President of the Illinois Central Company, their Agent. Mr. Newell has appointed Remington Vernam, General Manager, and W. H. Cruger, Superintendent. Mr. Cruger has had charge of the road for some years as Vice-President and General Superintendent.

—The directors of the Des Moines & Fort Dodge Railroad Company, organized by the second-mortgage bondholders of the Des Moines Valley road, are as follows: George Bliss, John L. Ludlum, F. C. M. Paton, David E. Green, Charles Dana, Charles E. Whitehead, George B. Smythe, John A. Elliott and C. O. Nourse. Charles E. Whitehead is President of the company.

—At the annual meeting of the Massillon & Cleveland Railroad Company in Massillon, O., Feb. 2, the old board of directors was re-elected, as follows: Kent Jarvis, J. G. Warwick, Massillon, O.; J. H. Rhodes, Cleveland, O.; Thomas D. Messler, J. N. McCullough, G. W. Cass, W. Stewart, Pittsburgh, Pa. Thomas D. Messler was re-elected President, and F. M. Hutchinson, Secretary and Treasurer.

—Mr. C. A. Swineford, last month appointed Assistant Superintendent, has now been appointed Superintendent of the Madison Division of the Chicago & Northwestern Railway, in place of Mr. J. H. Stewart, whose charge will hereafter be confined to the Winona & St. Peter Railway. Mr. Swineford's office is at Baraboo, Wis.

—Mr. Robert Neilson, heretofore Superintendent of the West Pennsylvania Division of the Pennsylvania Railroad, has been appointed Superintendent of the Elmira and Canadaigua divisions of the Northern Central Railway, these divisions including all of the road north of Williamsport, Pa. His office is at Elmira, N. Y.

—Mr. J. McC. Creighton, late General Agent at Pittsburgh, has been appointed Superintendent of the West Pennsylvania Division of the Pennsylvania Railroad, in place of Mr. R. Neilson, transferred to the Northern Central. His office is at Blairsville, Pa.

—At the annual meeting of the Avon, Genesee & Mt. Morris Railroad Company, in Rochester, N. Y., February 10, the following directors were elected: Willis Phelps, George W. Phelps, Springfield, Mass.; M. F. Reynolds, E. R. Hammett, H. L. Fish, Wm. Mudgett, Geo. Ellwanger, Rochester, N. Y.; Hiram P. Mills, H. E. Brown, L. C. Bingham, Wm. D. Fitzhugh, Mt. Morris, N. Y.; D. H. Fitzhugh, Wm. A. Wadsworth, Genesee, N. Y. The road is operated by the Erie Railway Company.

—The annual meeting of the Lowell & Andover Railroad Company was held in Lowell, Mass., February 12, and the following directors were elected: James C. Ayer, Gustavus V. Fox, Jacob Rogers, Horace J. Adams, E. M. Sargent, Geo. Ripley, Josiah Gates, Stark Totman, Frederick Ayer, Jacob Nichols.

—At the annual meeting of the Oil Creek & Allegheny River Railroad Company in Philadelphia, February 11, the following directors were elected: William Phillips, William M. Lyon, William R. Nimick, James S. Morrison, Pittsburgh, Pa.; Lev N. Wagner, William S. Lane, John N. Shriver, Philadelphia.

—Mr. George Noble, Assistant General Superintendent, having resigned to go to the Texas & Pacific, Mr. O. H. Dorrance is appointed Superintendent of the Kaw Valley Division

of the Kansas Pacific Railway. Mr. A. B. Garner is appointed Superintendent of the Smoky Hill Division in place of Mr. Dorrance, transferred to the Kaw Valley Division.

At the annual meeting of the Midland Railway Company of Canada at Port Hope, Ont., January 20, William Frazer, Adolph Hugel, N. Kirchhoffer, Lewis Ross and J. Fedor Schepeler were elected directors. The board re-elected A. Hugel President, and Fred. Whitehead Secretary and Treasurer.

The Rockford, Rock Island & St. Louis Railroad having been divided into two divisions, Mr. Henry Loosley, late Assistant Superintendent of the road, has been appointed Superintendent of the Northern Division (Sterling to Beardstown) with office at Rock Island, Ill. Mr. George L. Walker has been appointed Superintendent of the Southern Division (Beardstown to East St. Louis) with office at Beardstown, Ill.

Major Herman Kretz has been appointed Paymaster of the Texas & Pacific Railway.

Mr. W. S. Sneden has been appointed Receiver of the New Jersey Southern Railroad. He was connected with the road for a long time, having operated it at one time as lessee, and having been Superintendent until last year.

Mr. George Noble, late Assistant General Superintendent of the Kansas Pacific, has been appointed General Superintendent of the Texas & Pacific Railway.

TRAFFIC AND EARNINGS.

The earnings of the West Jersey Railroad for the year ending December 31, 1873, were:

Earnings (\$5,278 per mile).....	\$680,856 23
Expenses (69.5 per cent.).....	465,129 43

Net earnings (\$2,137 per mile)..... \$275,726 80

The earnings of the Oil Creek & Allegheny River Railroad for the year ending December 31, were:

Earnings (\$8,681 per mile).....	\$1,067,733 06
Operating expenses (68.5 per cent.).....	678,014 79

Net earnings (\$3,168 per mile)..... \$389,718 27

The earnings of the Marietta & Cincinnati Railroad for the first week in February, were: 1874, \$38,567; 1873, \$38,302; increase, \$265, or 0.11-16 per cent.

The earnings of the Michigan Central Railroad for the first week in February were: 1874, \$134,997; 1873, \$122,512; increase, \$12,485, or 10 1/4 per cent.

The Utah Central Railroad carried during January, 13,649 tons of freight, of which 8,835 tons was coal and coke.

The Utah Southern Railroad carried during January 6,646 tons of freight, including 2,199 tons of coal and coke, 1,754 tons of ore and bullion and 693 tons of iron ore and limestone.

The freight tonnage of the Bingham Canon Railroad for January was 3,072 tons.

The earnings of the Great Western Railway of Canada for the week ending January 23 were: 1874, \$23,655; 1873, \$17,600; increase, \$6,055, or 34 1/2 per cent.

The earnings of the Grand Trunk Railway for the week ending January 24 were: 1874, \$38,000; 1873, \$27,500; increase, \$10,500, or 38 1/2 per cent.

The coal tonnage of the Pennsylvania Railroad Company's New Jersey lines for the month of January was 82,228 tons, of which 54,200 tons went to South Amboy for shipment, 26,997 tons went to local points for consumption and 1,031 tons was for use of the company.

During the two months ending January 31, the coal tonnage of the Pennsylvania & New York Railroad was anthracite, 94,140 tons; bituminous, 38,234 tons; total, 132,364 tons.

The earnings of the Vermont & Massachusetts Railroad for the year ending September 30, 1873, were \$553,234.46, or \$6,309 per mile. This is a decrease from the previous year of \$1,962.12, or 0 1/4 per cent.

During the season of 1873, there passed through the Sault Ste. Marie Canal 968 steamers having a tonnage of 619,844 tons, 1,544 sailing vessels with a tonnage of 584,601 tons, and five rafts of logs, making a total of 2,517 passages through the canal, with a total tonnage of 1,204,445 tons. The receipts from tolls were \$44,943.18; other sources, \$55; total, \$44,998.18. The expenses for repairs, salaries and other purposes were \$19,715.29. The canal opened for the season May 5 and closed November 18, being open six months and 13 days.

The earnings of the Erie Railroad for the first week in February were: 1874, \$334,453; 1873, \$330,976; increase, \$3,477, or 1 per cent.

The earnings of the Chicago & Northwestern Railway for the first week in February were: 1874, \$191,141; 1873, \$165,229; increase, \$25,913, or 15 1/2 per cent.

The earnings of the Cumberland Valley Railroad for the year ending September 30, 1873, were:

Earnings (\$8.081 per mile).....	\$614,184 99
Expenses (46 per cent.).....	282,642 44

Net earnings (\$4,364 per mile)..... \$391,642 55

PERSONAL.

Judge R. C. Hurd, President of the Cleveland, Mt. Vernon & Columbus Railroad Company, died at his residence at Mt. Vernon, O., February 11, after a long illness.

The employees of the Winona & St. Peter Railroad recently presented a valuable gold watch and chain to Mr. J. H. Jenkins, Assistant Superintendent, besides a fine set of harness and buffalo robe to Mrs. Jenkins.

Mr. Rush B. Sloane, long President and Superintendent of the Cincinnati, Sandusky & Cleveland Railroad, but removed last October on charges of mismanagement, was arrested in Sandusky, O., on the 13th of February on 17 distinct charges of embezzlement preferred by the company. Bail was fixed at \$46,000. Civil suits have been brought against him for about \$150,000, and his property in Sandusky, Toledo, Chicago and Boston has been attached. A later telegram says that he did not appear for examination on the 17th, and that his bail was forfeited.

A correspondent of the New York Tribune, in the course of some reminiscences of amateur musical societies in New York about 25 years ago says that a leading society at that time, called the "American Musical Institute," was organized by Mr. Henry Meigs, now the great South American railroad contractor, whom he describes as "an enthusiastic musical amateur" who presided over the Society for some years, and whose energy gave to music in New York one of its strongest and most lasting impulses. "A strange contrast was brought to my mind in seeing at Tiffany's, two or three years ago, a magnificent piece of plate made for presentation to Henry Meigs by a party of gentlemen, in acknowledgment of some official courtesy or hospitality, and in remembering the same simple-hearted and kindly Henry Meigs, whom I used to know among the young people in the chapel of Dr. Chapin's old church, between Prince and Spring streets, his whole heart in music—of the practical part of which he was quite ignorant—cheering, encouraging, and getting together the choruses, which were indeed more numerous and efficient than those of our later organized societies, excepting, perhaps, the present Vocal Society of New York."

Mr. Daniel McLaren, for ten years past President and previously General Superintendent of the Cincinnati, Hamilton & Dayton Railroad, has resigned his position. He began his service on the road 25 years ago as Master Mechanic and was Superintendent 15 years.

CHICAGO RAILROAD NEWS.

Illinois Central.

The Land Department reports sales during January of 1,936.01 acres construction lands for \$14,119.93 and 119.4 acres free lands for \$1,194.00, a total of 2,055.41 acres for \$15,314.53. The cash collections during the month were \$37,143.02.

The earnings of the Traffic Department in January were:

	In Illinois.	In Iowa.	Total.
Freight.....	707 miles.	402 miles.	1,109 miles.
Passengers.....	\$317,067 00	\$78,804 00	\$395,871 00
Mails.....	98,746 55	26,013 45	124,760 00
Other sources.....	6,375 00	3,059 32	9,434 32
Total.....	78,625 00	2,710 68	81,335 68

Total, January, 1874.....	\$500,813 55	\$110,677 45	\$611,491 00
Total actual earnings, January, 1873.....	\$23,531 79	78,708 83	\$102,240 62

This shows a decrease of 43 per cent. in the Illinois earnings; an increase of 40 1/2 per cent. in the Iowa earnings, and an increase of 1 1/2 per cent. in the total earnings.

The application for the \$1,000,000 of 5 per cent. bonds with which this company is to purchase the Mississippi Central Extension bonds were for more than double the amount, the price being 84.

Chicago & Alton.

The mildness of the winter, and the consequent difficulty of getting about on Central and Southern Illinois farms, has reduced the earnings of this road to a considerable degree. It is reported that along the line of the track there are thousands of acres of corn that still remain unharvested, for the reason that it is impossible to drive loaded wagons over the ground.

A considerable number of excursion tickets have been sold to New Orleans and return, on account of the Mardi Gras festival.

Chicago, Rock Island & Pacific.

This company reports their receipts to be in excess of those of last year, for corresponding periods.

Freight Rates.

Shipments are taken at 95 and even 90 cents per hundred from Chicago to Liverpool by way of either New York, Boston, Philadelphia or Baltimore. There begins to be inquiry for vessels to load for Buffalo on the opening of navigation, and it is said that 8 cents a bushel for wheat and 7 cents for corn has been offered.

THE SCRAP HEAP.

Work of a Railroad Inspector.

As examples of the kinds of work which a railroad inspector may do, (if he knows enough), the following reports will serve, some of them very elaborate, prepared within a year by Mr. J. M. Goodwin, for the Atlantic & Great Western Company: Narrow-gauging the Ohio & Mississippi Railway; Narrow-gauging the Great Western of Canada and the Grand Trunk of Canada; Examination of a connecting railroad; Track and Maintenance of Way; Relative Merits of the Several Patterns of Locomotives for Freight Service; The Best Mode of Coal-Firing Locomotives; Protection of Railway Property Against Fire; On the Handling and Transportation of Coal and Ore. The last of these we have had an opportunity to examine slightly, and is certainly a very thorough and elaborate discussion of the question in its special relations to the Cleveland & Mahoning business.

Steel Rails on the Grand Trunk.

The Grand Trunk has now 520 of 1,377 miles of line laid with steel, concerning the durability of which Mr. Potter, the President, spoke as follows at the late annual meeting:

"Let me tell you a very curious little incident respecting the life of a steel rail. We have got on our line near Kingston half a mile of steel rails which were laid down in the year 1865. We have got that half mile of steel rails on the most crowded part of our line—laid down in 1865—therefore, over which eight Summers and seven Winters have passed. Now, not one single rail of that sixty or seventy tons has been changed, nor is there any appreciable sign of damage or wear and tear, except that the whole surface is smooth. We had those rails carefully examined and measured by a very delicate instrument. There is no sign of any wear of any kind whatever—none of them have broken—none of them are in any way touched, except that they have a perfectly smooth and even surface; and this instrument shows that, if the wear and tear of the rail continues as it has done for the last seven or eight years, those rails will last for 180 years. I tell you what the instrument shows—of course you must not suppose that I mean to tell you that they will last that time; but that is the simple fact—there is no appreciable wear and tear."

A New Fairlie Engine.

A Fairlie locomotive with 12 3 ft. 6 in. drivers and 16 by 20 in. cylinders, weighing 62 tons, made to burn either wood or coal, has lately been completed in England for the Mexican Railway. It is equipped with the Westinghouse brake, and also with the Le Chatelier counter-pressure steam brake, which acts only on the locomotive. The engine is to work on a long grade of more than 200 feet to the mile, and the boiler flues are inclined to suit this grade.

Steel Rails on the Reading Railroad.

The report of the Chief Engineer of the Philadelphia & Reading Railroad for the year ending with November last says:

"The introduction of steel rails on the main line commenced in September, 1865; and since that time 8,374 tons have been laid, of which 13 tons—being experimental rail and not proving satisfactory—were removed from the track. At one of the most trying places in Reading, 41 tons of steel rail were laid in August, 1867, at a point where the life of an iron rail never exceeded four months; and after having done service for six years they were removed in the fall of 1873, having been worn off uniformly to a thickness not considered suitable to the main track. These rails have been placed in sidings, where they will do duty for some years. There are now 8,301 tons of steel rail in our tracks, showing that only 19 tons were removed from causes of either accident, dents or defective manufacture."

The Franklin Institute.

The Franklin Institute of Philadelphia celebrated the fiftieth anniversary of its foundation in Philadelphia, February 6. Addresses were made by Mr. Coleman Sellers, President of the society, Mr. Fraley, one of its founders, Prof. H. E. Rogers, of the University of Pennsylvania, and Prof. Henry Morton, of the Stevens Institute of Technology.

Prices of Rails in January.

Bigelow & Johnston report foreign iron at \$56 to \$60 gold, and American at \$60 to \$64; foreign steel at \$108 to \$110 gold, and American the same in currency. There were no importations of iron at the port of New York, but 4,912 of steel, against 2,610 of iron and 3,776 of steel last year. Old rails are quoted

at \$45 for double-heads, \$40 to \$42 for T and \$38 to \$40 for U. There were no importations of old rails, but a large business, mostly speculative, the demand from consumers being quite small. For new rails there have been some considerable contracts for American, both steel and iron, and prospects are a little brighter.

OLD AND NEW ROADS.

Dividends.

The Chicago & Alton will pay the usual half-yearly dividend of 5 per cent. March 10 at the office of Morris K. Jesup & Co., No. 59 Liberty street, New York. Transfer books are closed February 21 and re-opened March 11.

The West Jersey Railroad Company paid the usual semi-annual dividend of 4 per cent., February 16.

The Adams Express Company will pay a quarterly dividend of 2 per cent., March 2.

Meetings.

Annual meetings will be held as follows: Lehigh & Wilkesbarre Coal Company at No. 135 South Second street, Philadelphia, February 26, at noon.

Cleveland, Columbus, Cincinnati & Indianapolis, at Cleveland, March 4, from 10 a. m. to 2 p. m.

Union Pacific, at Sears' Building, Boston, March 11.

The annual meeting of the Baltimore, Pittsburgh & Chicago Railroad Company (Illinois Division) will be held at the office, No. 96 La Salle street, Chicago, February 27.

The annual meeting of the Housatonic Railroad Company will be held in Bridgeport, Conn., February 27.

Railroad Entrances into St. Louis.

The board of engineers appointed by the citizens' committee have completed a plan for a new entrance into St. Louis for the railroad lines from the west. The St. Louis Republican says: "The plan agreed on comprises the straightening of the Pacific Railroad track and reducing the grade; establishing a strip of land 200 feet wide for the accommodation of all the roads that will reach the city through Mill Creek valley; carrying all the principal cross streets over the tracks on bridges; connecting the Iron Mountain Railroad with the western roads by a tunnel; construction of a union depot and depot buildings, and the improvement of the streets in the vicinity of the depot."

The engineers composing the board are C. Shaler Smith, Henry Flad and L. Rodgers.

The Illinois Tax on Capital Stock.

A meeting of counsel of railroad companies was held in Springfield, Ill., February 10, to agree upon action to be taken to contest the collection of the tax upon capital stock. The companies represented were the Chicago & Alton, Toledo, Wabash & Western, Ohio & Mississippi, St. Louis, Vandalia & Terre Haute, Indianapolis & St. Louis and Springfield and Illinois Southeastern. Mr. Green, counsel for the Toledo, Wabash & Western, was selected to draw a bill to be submitted to the other counsel.

Rochester & State Line.

The bill authorizing the immediate issue of the last installment of \$200,000 of the \$600,000 in bonds voted to this road by the City of Rochester has passed the New York Legislature.

Galveston, Harrisburg & San Antonio.

Work on the grading of the extension is progressing steadily. Contracts have been let for the construction of 12 additional miles, which will bring the road to a point 12 miles north of Gonzales, Tex.

Rochester, Nunda & Pennsylvania.

It is proposed to form a construction company to take the contract for the construction of this road out of the hands of the present contractors and to go on and complete the road. The road has been all located, the right of way secured and grading has been done on some 40 miles of the road, 10 miles of which is nearly completed. Ties, posts and material for 46 miles are on hand. The work is at present stopped for want of means.

Cairo & St. Louis.

A bill is now pending in the Illinois Legislature which provides that in all cases where counties or towns have subscribed to the stock of a railroad company conditionally, if the conditions are not fulfilled by March 1, 1874, then a new election shall be held to decide whether the subscription shall be paid or the bonds issued, as the case may be. The bill is general in its terms, but is intended chiefly to apply to the Cairo & St. Louis Company, which had considerable amounts voted to it in county bonds to be issued when the road is completed.

Baltimore & Ohio.

This company is now carrying freight from New York to Chicago at the following rates: first class and second class, 65 cents per 100 pounds; third class, 60 cents; fourth class, 60 cents; special class, 40 cents. Freight is carried from New York to Baltimore by steamer. The rates on first-class freight are 35 per cent. less than the winter rates adopted by the trunk lines.

Chicago & Lake Huron.

A meeting of Port Huron & Lake Michigan bondholders, who have accepted the proposition of the Chicago & Lake Huron Company (with which the Port Huron & Lake Michigan has been consolidated) to fund six coupons from their bonds, was held in New York, February 17, to protest against the action of a committee appointed by a few bondholders who have declined to accept the funding proposal and desire to foreclose the mortgage. Resolutions were adopted recommending all bondholders to accept the company's proposition and send in their coupons to the Union Trust Company to be exchanged for certificates of indebtedness.

St. Louis & St. Joseph.

This road was sold under foreclosure of mortgage February 18. It was purchased by the committee appointed by the bondholders for \$100,000. The amount of the first mortgage bonds was \$1,000,000, the holders of \$920,000 of which had assented to the appointment of the committee and signed the agreement made. The road is 76 miles long, from St. Joseph, Mo., southeast to the Missouri River a few miles south of a junction with the St. Louis, Kansas City & Northern, 234 miles from St. Louis.

Mobile & Montgomery.

A decree for foreclosure having been rendered, notice is given requiring holders of bonds and coupons to present the same for registry within three months at Montgomery, Ala. Drexel, Morgan & Co., of New York, agents for the committee, will receive signatures and deposits of bonds by all who have not already come into the bondholders' agreement, and all such bonds and coupons will be presented for registry by the committee.

New York & Oswego Midland.

Besides Allen, Stephens & Co., George Oddyke & Co. solicit the conference of first-mortgage bondholders with regard to the committee's plan of reorganization, which this house probably favors. Heidelbach, Frank & Co., of No. 52 Exchange place, New York, request bondholders "desirous of joining, for

the purpose of protecting their common interests, with the foreign holders of first-mortgage bonds, who are now rented to the extent of over \$2,000,000, to communicate with them.

Lake Ontario Shore.

There is talk of building a branch 25 miles long from Red Creek, N. Y., 21 miles southwest of Oswego, to Baldwinsville, on the Oswego & Syracuse road.

Boston, Barre & Gardner.

At the annual meeting recently, it was stated that of the \$400,000 in bonds authorized only \$300,000 has been used. The road is completed and the other \$100,000 remains to be used for terminal facilities.

Winthrop Branch.

It is proposed to build a line three miles long from Winthrop, Mass., across Breed's Island to a junction with the Eastern road to Chelsea.

Hartford, Providence & Fishkill.

During the past year 28 miles of track has been relaid with new iron and much work has been done in improving the road-bed. Several new sidings have been built and others extended. A side track one mile long has been built from Oneco Station to the Oneco Quarry. The equipment has been increased by four locomotives and 25 freight cars. Smith's vacuum brake has been applied to all the passenger equipment and the Miller platform is soon to be adopted. An agreement has been made to lease and work the Pawtuxet Valley Railroad as soon as completed.

St. Louis & Terre Haute Canal.

It is proposed to build a canal about 170 miles long from the Mississippi at St. Louis to Terre Haute, Ind., there to connect with the Wabash and Erie Canal. As the latter has not paid expenses for years, and is about to be abandoned, it is not likely that any one will put his money into the proposed canal if he ever wants to see it again.

Memphis & Knoxville.

This company offers to build and equip during the coming season the section of 18 miles from Pulaski, Tenn., on the Nashville & Decatur road, west to Lawrenceburg, provided the people on the line will subscribe \$80,000 in money and labor.

Colorado & New Mexico.

The bill before Congress to charter this company provides for a railroad from a point southwest of Granada, Col., west by south through Cimarron, N. M., to Santa Fe, with a branch to the Purgatory River in Colorado and another branch from Cimarron west to the Rio Grande, near Taos.

New Orleans, Mobile & Texas.

A bill is to be introduced shortly in the Louisiana Legislature to authorize the formation of two companies, one to operate the line from New Orleans to Mobile, the other to take the road west of New Orleans and to complete it to some point in Texas.

Flymouth County.

This proposed road is to extend from South Scituate, Mass., northwest through Hingham to the Old Colony road near Wollaston Heights in Quincy, a distance of about 14 miles. It is reported that the Old Colony Company will take \$180,000 in stock and will equip the road when finished, if other parties will furnish the balance of the amount needed.

Baltimore & Drum Point.

The directors have resolved to commence work on the line from Baltimore to the crossing of the Annapolis & Elk Ridge Railroad as soon as the subscriptions of Calvert and Anne Arundel counties are made, and to prosecute this part of the work simultaneously with the work south of the Annapolis Railroad.

Lake View & Collamer.

A company by this name has been organized to build a railroad from Cleveland, O., to Euclid, 10 miles. The capital stock is to be \$250,000, and the incorporators are John W. Heiseley, John Walworth, John D. Rockefeller, L. E. Holden, M. W. Montgomery, William West and H. M. Chapman.

Jacksonville, Northwestern & Southeastern.

This company proposes to extend its road from the present terminus at Virden, Ill., southeast to Hillsboro, about 30 miles, provided the people along the line will subscribe \$60,000. In Hillsboro, \$10,000 has been raised.

Grand Rapids & East Saginaw.

Colburn & Dickey, the contractors for the 33 miles from Maple Rapids, Mich., to the crossing of the Jackson, Lansing & Saginaw, have commenced work clearing and grubbing the line.

Worcester & Nashua.

At the annual meeting, February 2, the question of accepting an act of the Legislature relative to the endorsement of the bonds of the Nashua & Rochester Company came up and was deferred to a special meeting to be called hereafter.

New Jersey Southern.

A temporary arrangement has been made with the Receiver by the Tuckerton Railroad Company, whose road is absolutely dependant on the New Jersey Southern for an outlet and which has been much embarrassed by the stoppage of trains on that road.

Under this arrangement the Tuckerton Company will, for the present, operate the line from Whiting's Junction to Pemberton and also that from Waretown to Tom's River. Under this arrangement trains from Tom's River and from Tuckerton run through to Pemberton, there connecting with the Amboy Division of the Pennsylvania road. The first train under this agreement passed over the road February 13. A party of strikers detained it some time at Whiting's, but finally allowed it to pass.

A bill has passed the New Jersey Legislature which provides that when any railroad company shall fail to run trains for 10 consecutive days, the Chancellor may, on application, appoint a Receiver with power to run the road. The bill also makes wages of employees a first lien on the receipts.

Later dispatches announce that the Chancellor (probably under authority of the new law) has appointed Mr. W. S. Sneden Receiver with authority to run the road and to pay the employees two months' back wages out of the earnings. Mr. Sneden was formerly Superintendent of the road and possesses the confidence of the men. Arrangements will be made at once to re-open the road and trains will probably be running in a few days.

Macon & Brunswick.

The bill providing for the extension of this road has passed the lower house of the Georgia Legislature. The bill gives the company authority to build northward from Macon to a point on the Georgia Railroad. It is provided that if the company accepts the act, the Governor (who now has possession of the road, having seized it for non-payment of interest on bonds endorsed by the State) shall hold the road for two years and if the extension is completed within that time he shall restore the road to the company, the State accepting the net earnings for that time as full reimbursement for interest paid. The State will also loan as much convict labor as may be desired. The stock issued for the extension shall be separate from the present stock, but the road and its extension must remain one continuous line and under one management.

The Governor is to appoint seven commissioners to manage the road while in the hands of the State.

If the company declines to accept the act and build the extension these commissioners must sell or lease the road, provided that they may not sell it for less than \$1,250,000 in cash or \$1,500,000 in bonds endorsed by the State. The Governor is to have power to bid it in at such sale, if deemed best.

Memphis, Carthage & Northwestern.

This road is now open to Brownsville, Kan., 51 miles from the junction of the Atlantic & Pacific at Pierce City, and two miles beyond the late terminus at Shawnee.

Buffalo Cross-Town.

A company by this name has been organized to build a connecting railroad across the city of Buffalo to the International Bridge. The road is intended to furnish a direct connection through the city to any road which desires to reach the bridge. Application has been made to the City Council for the necessary permission.

Atlanta & Richmond Air Line.

A meeting of the bondholders was held in New York, February 13, when the committee appointed at the former meeting reported that they had examined the road and equipment and believed that the mortgage was amply secured and that the road was a valuable property. A committee was appointed to perfect the steps already taken for a foreclosure of the mortgage, with power to buy the road and hold it in trust for the first-mortgage bondholders. The committee consists of George H. Mumford, John H. Fisher, Hiram W. Sibley, B. B. McAlpin, Alex. P. Irvin, Adrian Iselin, Skipworth Wilmer, Eugene Kelly and Lucius Tuckerman.

It is stated that there is some probability of a compromise with the Pennsylvania Railroad Company, which owns a majority of the stock.

Baltimore & Annapolis.

A bill is before the Maryland Legislature to charter a company to build a railroad of 3-feet gauge from Annapolis, Md., to Baltimore.

New York Central & Hudson River.

Much opposition has arisen to the proposed plan of carrying the additional tracks through Rochester at a high grade requiring bridges over nearly all the streets. It is thought that the Board of Public Works will refuse to grant the necessary permission to the company.

Pittsburgh, Wheeling & Kentucky.

Meetings are being held to devise means for completing this road. A general meeting of the stockholders is to be held shortly. The general feeling seems to be in favor of setting aside the contract by which the company assigned its property to Messrs. Pendleton and Hubbard.

Atlantic & Southeastern.

Surveys have been commenced for this road, which is to be an extension of the Niles & New Lisbon southward to Hopedale, O., where it will connect with the Wheeling & Lake Erie road, now under construction. It will be about 36 miles long.

St. Paul & Pacific.

A bill is before the Minnesota Legislature requiring that debts due to citizens of Minnesota for labor, materials, etc., must be paid before the lands earned are deeded to the company. The principal claim covered by this bill is that of De Graff & Co., contractors for the building of the St. Vincent Extension, who have some \$532,000 due them for work actually completed. De Graff & Co. completed 143 miles of road after the company had stopped paying their estimates, thereby saving a large part of the land grant to the company.

Natchez, Jackson & Columbus.

This company invites proposals for the construction and completion of its road from Natchez, Miss., to Fayette, 25½ miles, the contractor to equip the road and erect all necessary buildings. The rails are laid for 9.8 miles from Natchez and the road is graded 3½ miles further, and a construction train is now in use. The estimates of the Chief Engineer put the cost of construction of the new road required at \$14,167 per mile, or \$208,946 in all. The road is of 3 feet 6 inches gauge, and is to be laid with fish-bar iron, not less than 35 pounds to the yard. The company will furnish 100 tons of rails now on hand and timber for all the bridges for 3.44 miles from the present end of the track. The work must be completed in 16 months. No money will be paid on the contract. The company's resources consist of \$134,900 of 7 per cent. bonds of Adams County, Miss., and its power of leasing or mortgaging the road, which is now unencumbered. Proposals will be received at the office of the company in Natchez, Miss., until May 1.

Wisconsin Central.

A survey has been made of 29 miles of the unfinished section between Worcester, Wis., and Penokee. A supply road has been cut through between these points.

The company has made application to the Governor of Wisconsin for certificates for all the land grant on the line completed from Stevens' Point northward and from Ashland southward. The late Governor refused to issue certificates for more than half the land grant on those sections, on the ground that the line from Portage north to Stevens' Point should have been built before that from Stevens' Point northward.

Galion, Loganport & Chicago.

At a meeting held in Galion, O., recently it was stated that arrangements had been made to commence work as soon as the right of way and subscriptions to the stock are secured. The surveys from Galion to Lafayette, Ind., are to be made early in the spring.

Indianapolis, Bloomington & Western.

The first mortgage 7 per cent. gold bonds, the amount of which is \$5,000,000, and the second mortgage 8 per cent. currency bonds, amount \$1,500,000, have been put on the list at the New York Stock Exchange. The accompanying statement gives the amount of capital stock authorized as \$15,000,000; issued, \$5,867,200.

International & Great Northern.

The following bonds of this company have been put on the list at the New York Stock Exchange: International Railroad first mortgage 7 per cent. bonds, amount \$3,232,000, and convertible 8 per cent. bonds, amount \$2,020,000. Houston & Great Northern first mortgage 7 per cent. bonds, amount \$4,144,000, and 8 per cent. convertible bonds amount \$2,590,000, secured by second mortgage.

Baltimore & Potomac.

Work on the depot in Washington is shortly to be resumed, the contractors having received orders to commence work as soon as the material arrives. It is intended to have the building completed during the coming summer.

New York & Oswego Midland.

It is stated that there is a strong feeling of opposition among the first-mortgage bondholders to the proposed plan of reorganization. The main points of objection appear to be the lease of the Montclair road at a rent which will amount to very nearly \$200,000 per annum and the proposed issue of \$1,500,000 of bonds to build the road from Middletown to a junction with the Montclair and to pay the expenses of reorganization. These bonds would be a first lien and the new

bonds to be issued in place of the present first-mortgage bonds would have only a second lien. It is also claimed that the proposed issue being at the rate of \$30,000 per mile, while the present issue is only \$20,000, the value of the bonds will be less than the present issue. It is also objected that the Western Extension can never pay interest on the proposed issue of \$30,000 per mile on that line. On the other hand it is claimed that the Western Extension is of no value in its present condition and that it must be completed in order to make it produce anything. It is also claimed that the main line also cannot be valuable until it is completed to New York, which it is claimed can be done more cheaply by leasing the Montclair than in any other way.

Burlington & Missouri River.

The trustees will receive until noon of March 2 sealed proposals for the sale to them of \$100,000 of the company's 7 per cent. land mortgage bonds. Proposals are to be addressed to John N. Denison, Treasurer, at the office of the company in Boston.

Chesapeake & Ohio.

Holders of the first-mortgage bonds are asked to send their addresses and the amounts of their holdings to H. I. Clarke, No. 193 Pearl street, New York, "in order to obtain concerted action if necessary."

Memphis & Little Rock.

New iron is being laid on the road from Devalls' Bluff, Ark., westward.

Atlantic & Gulf.

It is stated that the State of Georgia will probably give its stock in this Company to the Company in aid of the proposed extension from Bainbridge to Pollard. It is said also that the City of Savannah will take the same course.

Selma, Marion & Memphis.

This company is again asking the business men of Memphis to advance money to complete the road. The amount now asked is \$150,000, for which the company's drafts, payable in 12 months, are to be given. A committee has been appointed to investigate the affairs of the company.

Green Pond.

A company by this name has filed articles of association under the New Jersey general law. The capital stock is \$100,000, and the road is to be four miles long, near Green Pond, Morris County. It is intended mainly for the transportation of iron ore.

Toledo, Peoria & Warsaw.

James F. Secor and William Tracy, trustees under the consolidated mortgage of 1870, took possession of the road, February 3, under authority of a clause in the mortgage which authorizes the trustees to take possession at any time after 90 days' default in payment of interest. The trustees have appointed Mr. John Newell, President of the Illinois Central Company, their agent, and he has appointed Remington Varnam General Manager and has continued Mr. W. H. Oruger as Superintendent. This step is probably taken as preliminary to the proposed reorganization of the company.

Fort Wayne & New Haven.

A company by this name has filed its articles of incorporation with the Secretary of State of Indiana. The capital stock is to be \$50,000 and the line will be six miles long from Fort Wayne eastward to New Haven.

Vermont & Massachusetts.

At the annual meeting in Fitchburg, Mass., February 11, the stockholders voted to set aside 10 per cent. of the rent to be paid by the Fitchburg Company annually as a sinking fund. It was also resolved to change the time of holding the annual meeting to the first Wednesday in June, beginning with 1875. No annual report will be made until the accounts are made up to January 1, 1874, at which time the road passed into the hands of the lessees.

New York, Providence & Boston.

A contract has been closed with the Washburn Rolling Mill, of Worcester, Mass., for 1,000 tons of rails for the 10 miles of second track remaining to be built between Providence and Stonington.

Wheeling & Lake Erie.

The report of the Chief Engineer states that five lines have been surveyed from Martin's Ferry, O., opposite Wheeling, to Sandusky. The line finally adopted by way of Bowerstown, Zoar, Navarre, Lodi and Milan is 160 miles long, has no grades over 53 feet to the mile and very few miles over 40 feet. No line has yet been surveyed from Sandusky to Toledo.

The contract with Mr. Shanly calls for a minimum of \$5,000 per mile of local aid. Work has already been commenced near Navarre.

The City Council of Wheeling, West Va., has repealed the ordinance granting \$300,000 in aid of the building of this road. The ordinance appropriating \$300,000 to the Wheeling & Ohio Union Railroad was repealed at the same time.

Baltimore, Pittsburgh & Chicago.

The work of tracklaying from Deshler, O., westward toward Defiance has been commenced.

Green Bay & Minnesota.

A strike took place recently at Dodge Station, 10 miles from Winona, but it was stopped by the payment of the wages due the strikers.

Reports that the road was to be consolidated with the Winona & St. Peter have been contradicted by authority.

It has been decided to proceed at once with the construction of the elevator and other buildings on the east side of the Mississippi opposite Winona. Regular trains will run into Winona as usual, but all river freight will be transferred on the east side, thus avoiding the tolls for the use of the bridge at Winona, the tolls being paid on the number of cars passing over.

Rockford, Rock Island & St. Louis.

This road has been divided into two divisions, the Northern extending from Sterling, Ill., to Beardstown, 170 miles, and the Southern from Beardstown to East St. Louis, 111 miles.

Announcement is made that there will be a meeting of the bondholders and stockholders at the office of the Union Trust Company, New York, on the 25th of February, at noon, to consider a plan for reorganization.

Northern Extension of Canada.

This company recently offered in the London market a issue of £38,800 of 6 per cent. bonds, interest guaranteed by the Northern Railway Company, which leases the line, at the price of 95. The lines to be built with the proceeds are to extend from the northwest terminus of the line of the Northern Railway at Collingwood westward about 40 miles to Owen Sound, and from Barrie (30 miles southeast of Collingwood) northward to some point not mentioned on Georgian Bay, and together will measure 109 miles. The company has subsidies amounting to \$262,500 from municipalities, and \$194,000 from the Government of Ontario. The bonds are at the rate of \$12,000 per mile. Fifty-six miles of the road are in operation.

Portland Railroad Matters.

The bill presented in the Maine Legislature provides for a marginal railroad entirely around the city of Portland, Me.

The road is to have a double track, and is to be built and owned by the city, which is to grant equal rights to all the companies whose roads enter the city. The bill is said to be approved by the business community of Portland and by all the companies interested.

Cincinnati Southern.

A Cincinnati dispatch states that the trustees have located the line from Roberts' Store, Ky., to Cincinnati, 22 miles, on what is known as the Ludlow or western route. This will make necessary the construction of a new bridge over the Ohio in the western part of the city.

Northern Central.

It is stated that an informal meeting was held in Philadelphia recently to consider once more the question of leasing the road to the Pennsylvania Railroad Company. The terms asked last year were 8 per cent. on the stock. It is reported that the present proposal is for a lease at 7 per cent. on the stock. The suit commenced in Maryland last year to enjoin the directors from making any lease is, we believe, still pending.

Portland & Ogdensburg.

The City Council of Portland, Me., has ordered the issue of an additional \$50,000 in city bonds to this company, making \$550,000 of the city's subscription paid over to the company.

Peoria, Atlanta & Decatur.

Recently suit was brought to enjoin the payment of interest on bonds issued by the towns of Oran and Atlanta, Ill., in aid of this road, on the ground that the bill chartering the company did not pass the Legislature legally. The Circuit Court has decided that the charter is valid, and has dissolved the preliminary injunction.

Connecticut River.

This company sold 500 shares of new stock at auction February 7. The stock sold at \$135 per share, the par value being \$100. The company has paid 10 per cent. dividends on its stock for some years.

Boston & Lowell.

This company has applied the vacuum brake to some of its through trains. Several of the local trains have been equipped with it for some time.

Lafayette, Bloomington & Mississippi.

On suit of J. B. Bayless, trustee of the stock issued to the Toledo, Wabash & Western Company, a temporary injunction has been served on the President and directors chosen by the township stock at the recent election.

Central Pacific.

Work on the grading of the new line from Santa's, Cal., by way of Antioch to Oakland has been suspended. Some grading has been done, and considerable work on a tunnel near Martinez.

Valley, of Virginia.

Construction trains are running from Harrisonburg, Va., up the valley 15 miles to Mount Sidney, 10 miles below Staunton. The work of tracklaying is progressing southwestward.

Chicago & Northern Pacific Air Line.

Suit has been commenced in the New York Supreme Court by Harris, Case & Co., sub-contractors, against the Chicago & Northern Pacific Construction Company, which had the general contract for the construction of this road. The suit is for \$10,000 due for work and materials furnished and for \$30,000 for damages sustained by delay and by being obliged to discontinue work.

Mercer & Somerset.

The extension from Hopewell, N. J., northeast to East Millstone is now ready for use, and has been turned over to the Operating Department. Regular trains will soon be put on over the whole road. It is 22½ miles long from Somerset Junction on the Belvidere Delaware northeast to a junction with the Millstone & New Brunswick road at East Millstone. It is leased and worked by the Pennsylvania Railroad Company.

Cincinnati, Sandusky & Ohio.

Rush B. Sloane, late President of this company, has been arrested on charges of embezzlement. The company has also commenced civil suits to recover some \$150,000, and has placed attachments on Mr. Sloane's property.

Boston & Albany.

At the annual meeting in Boston, February 11, a proposition was made to build a branch road from the Ware River road at Coldbrook, Mass., to Barre, a distance of nine miles. The matter was referred to the board of directors.

North Shore, of Canada.

The Toronto (Ont.) *Monetary Times* says: "Mr. McGreevy, of Quebec, has bought out the American contractors who undertook the contract of the North Shore Railway, but failed to comply with its terms."

The Preliminary Surveys for the Texas & Pacific Railway.

[A paper read before the Civil Engineers' Club of the Northwest, February 9, 1874, by C. W. Durham.]

When the Texas & Pacific Railway Company, in the spring of 1872, entered upon the work of making surveys for their line from the Arkansas River to the Pacific Ocean, they were by no means undertaking an experimental enterprise. The territory through which they wished to pass was not an unexplored one; its resources and wealth had long been known, and its topography and adaptability to railway purposes determined many years previous to the organization of the existing company.

Public attention was first drawn to our Mexican acquisition by the publication in 1848 of the report of Lieut. Emory, who accompanied the expedition under Gen. Kearney from Fort Leavenworth to San Diego in a scientific capacity. His description covers the western 500 miles of the proposed railway route.

Only five years later steps were taken by the War Department, under authority from Congress, to thoroughly explore all the territory between our Northern and Southern boundaries, in order "to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean." These explorations and surveys were made between the years 1853 and 1856, and were conducted on the 32d, 35th, 38th, 42d and 46th parallels, the results being given to the country in the 13 volumes of Pacific Railroad Reports, which contain, in short, all that is to be told of the territory in question, and furnish the data and maps upon which were instituted the surveys undertaken in after years by private enterprise.

Lieut. John G. Parke and Capt. John Pope were assigned

the command of the parties to operate on the 32d parallel, the latter exploring from Fulton, on the Arkansas River, to the Rio Grande, and the former thence to the Pacific Ocean at San Diego; and the lines recommended by these officers are followed essentially by the Texas & Pacific Railway Company.

Concerning the respective merits of the several transcontinental routes, Jefferson Davis, Secretary of War, in his Annual Report, December, 1855, says: "The reports of the officers employed under the appropriation made for explorations and surveys to ascertain the most practical and economical route for a railroad from the Mississippi River to the Pacific Ocean, were submitted to Congress on the 27th of February last, with a report from this Department giving a general sketch of the country over which they extended, a recapitulation of their results, and a comparison of their distinguishing characteristics, from which it was concluded that of the routes examined, the most practical and economical was that of the 32d parallel," and further states that subsequent discoveries have added to the feasibility of this favored route, and developed, among other features of interest, the fact "that the Colorado Desert, which is traversed by this route for 133 miles and which in the report referred to was noted as consisting of a soil that needed only water to render it highly productive, is in fact the delta of the Colorado River, and according to barometric levels is so much lower than that stream as to be easily irrigated from it," (a fact which has recently been announced as a late discovery).

And a report from Capt. A. A. Humphreys to the War Department, November 29, 1856, gives a tabulated statement showing the length, cost, etc., of the several routes. As compared with the 42d parallel route from Council Bluffs, the 32d parallel route shows a saving in distance to the Pacific Ocean of 500 miles, in estimated cost of 48 millions of dollars, and in altitude of highest point on the line of 3,300 feet; and presenting also more favorable conditions of climate, and allowing of greater rapidity in construction, from the fact that the work could be prosecuted east and west from Fort Yuma, at the head of the Gulf of California, as well as from both ends of the line.

A transcontinental route possessing so many advantages could hardly fail of attracting attention during the era of speculation in railroad building which followed the civil war. A charter, with valuable franchises, was early granted by Congress and money and land by the State of Texas, and these finally became by purchase the property of the Texas & Pacific Railway Company, which at once commenced, almost simultaneously, the work of location and construction.

The plan of operation adopted was most comprehensive in its conception and thorough and complete in its results. It was of the utmost importance to the financial prosperity of the company that they should secure estimates of cost as soon as possible, and to this end the route was divided into four divisions of about 375 miles each in length, and surveying parties placed at work on them as quickly as the expeditions could be equipped and reach their destination.

The engineers appointed to the Eastern and Western Texas divisions were ordered to report at Marshall, the eastern terminus; those for the California Division at San Diego, while those for the New Mexico Division gathered at Pueblo, Colorado, then the terminus of the Denver & Rio Grande (narrow-gauge) Railway, and the nearest convenient point to their portion of the line. It is the movements of these last that this paper is intended to chronicle.

The organization of all the expeditions was effected as follows: the division engineers placed in charge of the several expeditions purchased at the appointed rendezvous horses, mules, wagons, tents, cooking utensils, and all the paraphernalia of a surveyor's camp, as they deemed necessary; whatever was not procurable was sent from New York on requisition. The Division Engineer also procured teamsters and cooks, chose a quartermaster, and filled up the vacancies not provided for by the Chief Engineer. To him was delegated the perfecting of all details, and absolute control of the movements of the expedition under written instructions from the Chief Engineer, which were accompanied by the Government maps of surveys on the 32d parallel, with the reports upon the same, designating the presumptive route to be finally adopted and specifying others for examination.

With each expedition were two or more surveying parties denominated *main* and *side* party, whose field operations were directed by a "Principal Assistant Engineer." The complement of men to each was ordinarily greater than is usual in the States, but often reduced by desertion. The side party, as the term implies, was to be used in localities where a choice of location was presented, and when not absent from the main party was consolidated with it. In California, where the three practicable routes across the Coast Range Mountains diverged widely, each party became an expedition in itself, and needed a complete outfit; but in the New Mexico Division, the side party had occasion to make short reconnaissances only, and in but one instance was absent more than three days, requiring merely a single wagon for transportation purposes. The total number of men attached to each expedition varied considerably, being influenced, of course, by the physical difficulties to be overcome in running lines. On the New Mexico Division were but 28, distributed as follows: the Division Engineer, two Principal Assistant Engineers, two transmitters, two levelers, two rodmen, four chainmen, four laborers, two draftsmen, a topographer, geologist, quartermaster, two cooks and four teamsters, and the outfit consisted of three four-mule Bain wagons, a light two-horse wagon, six "A" tents for three persons, and two wall tents for headquarters purposes. There were provided extra transits and levels, against breakage, and also an aneroid barometer, which however lacked occasion of use.

Each individual provided for his own comfort in the matter of blankets, etc., the company furnishing nothing beyond transportation, food and shelter, and protection from Indians. In this connection I wish to recommend for use on similar

expeditions a small hair mattress, manufactured to order, 30 inches wide and six feet long, weighing 18 pounds. They are not more bulky than an equivalent in blankets, and conduce more to the physical comfort of a tired body than any other article can when hay or straw are not procurable. Hair mattresses on the plains sounds like an anomaly, but the hardest frontiersman in the expedition would gladly have possessed one; and whatever scorn greeted the introduction of this refinement soon changed to longing.

For supplies of provisions arrangements had been made with the War Department to furnish them at cost and transportation added from the military posts nearest the line; a suitable escort of cavalry was also provided to attend the expedition from Forts Selden and Bowie whenever they were ready to enter the dangerous Apache country.

Everything being in readiness, the expedition moved from Pueblo on the 5th of June, 1872, about three weeks after the first appointments had been made, fully equipped for a year's service in the field. The initial point was Fort Bliss in Texas, across the Rio Grande from the ancient Mexican town of El Paso, distant about 630 miles. Traveling 630 miles in freight wagons does not appear in an agreeable light at first thought, but in reality it was a matter of great good fortune. The gradual acclimation was, without a doubt, of the greatest benefit to the health of the men; the slow transition through 10 degrees of latitude saving the system the trying ordeal of a sudden change of climate which had to be undergone by those who could reach their rendezvous by rail and water. The change in manner of life, food, etc., always causes sickness in a surveying party, and in this instance the bad quality of the water was especially felt; but one could always find comparative comfort in the wagons, and mere journeying on smooth roads at an easy pace was not trying to an invalid. On the contrary, the trip was not only highly beneficial as preparatory to life in a hot climate, but exceedingly interesting and enjoyable.

The route lay due south through Trinidad, crossing the Rocky Mountains at the Raton Pass, on the borders of New Mexico, to Fort Union, through Las Vegas, and passing to the east of Santa Fe, through Anton Chico, and then descending west to Albuquerque, on the Rio Grande, followed its valley past Forts Craig and Selden, through numerous small pueblo towns, to the thriving towns of Las Cruces and La Mesilla (the latter named as the headquarters for the Division), and thence 40 miles to Fort Bliss, arriving the 3d of July, after 28 days on the journey, and on the morning of the 4th the first stake was driven and work commenced, the levels being based on a barometrical elevation of 3,700 feet obtained from the hydrographic officer stationed at the fort.

The physical features of New Mexico differ widely in their characteristics and composition from those we are familiar with east of the Mississippi; but it is utterly impossible that this paper shall give any adequate conception of nature as presented there, and perhaps it is not consistent strictly with its purpose of technical information. However that may be, there are several curious facts of general interest which were developed during the prosecution of the surveys which deserve mention hereafter.

From Fort Bliss the line was to ascend the Rio Grande some 30 miles to the vicinity of Mesilla and then turn West. The first three miles lay through a canon in a Mountain range, and in this canon was the monument marking the Mexican boundary line of 1853. Just north of it the side party diverged with a line up the west bank. Spreading out from the entrance to the canon the river bottom occupies a width of four miles of productive land for fifty miles north. On the east is the range of the Organ Mountains, whose peculiar sharp, pinnacled summits of granite are landmarks for a hundred miles; on the west is the Mesa, the tableland, the plateau of the Sierra Madre. Viewed from the opposite side of the river at a distance of five miles, the summit of the Mesa is a horizontal line against the sky, with an altitude, estimated by Americans resident at Mesilla, of 40 feet. Its ascent, however, required eight miles of 62 feet grade. Its slopes, which are in places precipitous and present a wall of black basaltic rock, are covered, when there is any vegetation, with the thorny mesquite, a most annoying barrier to deal with in running a line.

The parties reunited about 25 miles above Fort Bliss, and it was in the carrying of the line across the river by the main party that the only fatal casualty attending the expedition occurred. The Rio Grande is a rapid, changing stream, with uncertain channel and quicksand bottom, and the party attempting its passage without boats, the rear chainman was drowned. At the junction of the lines the ascent of the Mesa was commenced. Delay in receiving the escort of cavalry kept the parties in the valley until August 1st, on which day they turned toward the Pacific, and for 125 miles worked together as one.

In leaving the Rio Grande the expedition entered upon a new experience, and altogether a pleasant one; the Mesa presented a clear surface, free from brush and timber and all hindrance to rapid progress, the mosquitoes which had been so annoying were not found there, and the terrible heat, so oppressive in the valley, abated its force considerably. But on the other hand, for 200 miles ahead the water supply was uncertain, and this element in the risks to which the expedition was to be exposed became at once the most vital and important to be provided for. It necessitated the use of one wagon loaded with barrels, as a water wagon, and on alternate days this was despatched to the nearest known water for supplies.

The sources of supply, which were mostly waterholes, were in most cases situated on the mail route and off the line from three to ten miles, and at intervals of from six to forty miles apart, their position being known from the Government Reports.

In this distance of 200 miles, from the Rio Grande to the Arivaypa River, there were but ten of these springs or waterholes, and no running water was met with on the line of survey between the rivers mentioned.